Swine Health Information Center

2022 Progress Report

December 15, 2022

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Executive Summary

Swine Health Information Center

Swine Health Information Center Organization (additional information on page 19)

The Swine Health Information Center (SHIC) began operation as a 501(c)(3) corporation on July 4, 2015. The mission of SHIC is to protect and enhance the health of the United States swine herd through coordinated global disease monitoring, analysis of swine health data, and targeted research investments that minimize the impact of future disease threats.

The National Pork Board (NPB), National Pork Producers Council (NPPC) and the American Association of Swine Veterinarians (AASV) have each appointed two representatives to the SHIC Board of Directors. Three at-large producer representatives are also members of the Board. The Board approved a 2022 operating budget, a 2022 Plan of Work and a plan for FDIC insured investments, that is modeled after that of the National Pork Board.

A Monitoring and Analysis Working Group and a Preparedness and Response Working Group have been formed to provide program oversight and decision-making. Each are actively meeting via conference calls to fulfill their respective objectives.

When the Swine Health Information Center was formed July 1, 2015, by a grant of Checkoff funds from the National Pork Board, it was with the understanding 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 National Pork Board's Board of Directors voted to provide $15M to continue to fund SHIC's work through 2027.

SHIC announced Megan Niederwerder, DVM, PhD, has been chosen for the new role of associate director. Most recently an assistant professor in the Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine at Kansas State University, Niederwerder started with SHIC April 1.

Swine Health Information Center 2022 Outreach (page 21)

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 international meetings and with international organizations have helped to monitor swine diseases and issues around the world.

SHIC Served as Stakeholder Reviewer to USDA-ARS Search for Influenza Research Scientist (page 23)

SHIC was on an interview panel to give input to the selection of a research microbiologist in the USDA-Ag Research Service Virus and Prion Research Unit, located in Ames, IA. The panel was made up of ARS scientists and staff plus one pork-industry stakeholder representative.

Progress on the Swine Health Information Center 2022 Plan of Work

Preparedness

$650K Grant from USDA NIFA to Investigate ASFV Stability in Soybean Products (page 24)

SHIC was awarded a $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.

SHIC Collaborates on Initiation of North American Swine Veterinarians Meetings (page 24)

During a meeting between SHIC and the Canadian Pork Council (CPC) on May 18, 2022, discussions occurred on similar ASFV issues and research topics. SHIC and CPC agreed that regular meetings between the North American swine veterinarians (US, Canada, Mexico) would be helpful for discussing ASFV and other issues affecting North American swine. SHIC discussed this with the US pork organizations (NPB, NPPC, AASV) and collaborated with NPPC to move this effort forward and initiate regular meetings. NPPC now leads coordination of meetings, which are planned to continue quarterly.

SHIC-Funded Project Looking at Vehicle Networks and Disease Dissemination (page 24)

Work being conducted by Dr. Gustavo Machado and colleagues at North Carolina State University seeks to determine between-farm contact networks formed by different vehicle movements. The team has developed a novel model to reconstruct vehicle movement networks. Ongoing work will identify the vehicles that create more connections among the farms and consequently may play a role as disease super-spreaders in the network.

SHIC-Funded Study Looks to Other Industries for Infectious Aerosol Biocontainment Ideas (page 25)

A project funded in 2021 to evaluate technologies to prevent the spread of infectious bioaerosols has made progress. Led by Dr. Montse Torremorell at the University of Minnesota, the project is identifying existing and emerging technologies across different industries for their ability to contain bioaerosols in the face of swine disease outbreaks. Next steps will be to research feasibility and cost effectiveness of potential biocontainment technologies.

African Swine Fever Virus Stability in Feed Held at Three Storage Temperatures (page 25)

A new publication in the journal Transboundary and Emerging Diseases entitled “Stability of African swine fever virus in feed during environmental storage” details the length of time ASFV remains stable in feed at different storage temperatures. The robust study was conducted by a research team at Kansas State University led by Dr. Megan Niederwerder, now Associate Director of the Swine Health Information Center.

Study on Feed Goes Beyond Mathematical Half-life Calculations (page 26)

SHIC funded a study on time by temperature risk mitigation practices in feed storage. For the first time, scientifically sound data based on the use of infectious agents and representative conditions are

available to inform the industry on how long, and at what temperature, to store feed and feed ingredients to minimize risk. Previous storage periods for feed were based only on mathematical half-life calculations, not controlled studies using live pathogens and representative conditions.

SHIC Collaborates with DHS on NPB Grant Investigating ASFV Stability in Fecal Slurry (page 26)
SHIC assisted NPB in the transfer of a $370K grant to the US Department of Homeland Security Science and Technology Directorate entitled "Characterizing survival and transmission of African swine fever virus in fecal slurry." Further, SHIC collaborated with DHS on project objectives and procedures to achieve these objectives, discussed standard operating protocols for research objectives, and provided fecal slurry and diagnostic assay materials for experimental studies.

Monitor and Mitigate Risk to Swine Health

SHIC/AASV Webinar Addresses Undiagnosed Respiratory Disease Pursuit and Sampling (page 26)
Undiagnosed Respiratory Disease: How to Sample for Success and What's New, an "industry chatter" webinar presented by SHIC and AASV, included viewpoints of practitioners, diagnosticians, and pathologists all seeking answers to ongoing respiratory issues. The webinar was attended by 149 people from 23 countries.

SHIC Joins NPPC Swine Veterinarian Trip to Puerto Rico (page 27)
SHIC joined a group of 15 US-based veterinarians on a learning trip to San Juan, Puerto Rico, in late August. The tour, organized and led by NPPC, provided first-hand observations of the current ASFV prevention and surveillance programs on the island just 80 miles from the Dominican Republic where ASF is an ongoing risk and challenge. Traveling to Puerto Rico to see the day-to-day work of USDA and Customs and Border Protection provided the veterinarian team with valuable first-hand experience on the ASFV prevention efforts in the Caribbean.

SHIC-Funded Project Pursues Disease Warning Tool (page 27)
In a SHIC-funded effort aimed at increasing swine disease prevention and preparedness, staff with the Morrison Swine Health Monitoring Project have developed a methodology to communicate with project participants whenever a swine disease is occurring in the region near their sites. Whether an endemic or emerging disease, the goal is to be able to quickly report regional status to producers, allowing them to take precautions to protect their herds, per Dr. Mariana Kikuti, researcher, University of Minnesota Department of Veterinary Medicine. Dr. Kikuti and her colleagues say this project is possible because of MSHMP's primary mission, capturing and analyzing swine health data on a weekly basis from participating farms.

SHIC Funded MSHMP Reports on 2022 Results and Progress (page 28)
The Morrison Swine Health Monitoring Project (MSHMP), funded primarily by SHIC, helps identify industry needs via input from the project's participants, representing more than 50% of the nation's sow herd, and other sources. MSHMP has monitored and reported trends in pathogen incidence and prevalence, including PRRS and the PRRS 1-4-4 L1C variant, analyzed data to look at the association of manure pumping activities and PRRS outbreaks, and has helped with PRRSv outbreak investigations by comparing sequences. MSHMP has facilitated sharing swine health information by tracking multiple

diseases, including transport and health relationships, and is growing by adding boar stud and growing pig data to the sow information already gathered.

SHIC Initiated Swine Disease Reporting System Continues to Expand with IAV-S and PCV2 (page 28)
The Domestic Swine Disease Reporting System, funded by SHIC, collects and disseminates information on endemic and emerging diseases affecting the US swine herd. Following the addition of influenza A virus in swine (IAV-S) in April 2022, porcine circovirus type 2 information was included starting in May 2022, in response to stakeholder requests. Tracking IAV-S and PCV2, along with porcine reproductive and respiratory syndrome virus and Mycoplasma hyopneumoniae, the SDRS now monitors the whole suite of porcine respiratory disease complex.

SHIC's Domestic Swine Disease Monitoring Report Renewed for 2023 (page 29)
Since March 2018, SHIC's Domestic Swine Disease Monitoring Report has been published monthly on its website and in its newsletter. Funded by SHIC and produced by the Swine Disease Reporting System team, the report provides real-time updates on megatrends of disease agent activity over time, age group, specimen, and states using data from five midwestern VDLs. In their renewal proposal, SDRS staff will maintain current aggregated PCR detection databases for PRRSV, PEDV, PDCoV, TGEV, IAV-swine, PCV2, and Mycoplasma (MHP). IAV-swine and PCV2 were added to the monitoring report in 2022.

SHIC Explores Expansion of Domestic Swine Disease Reporting System (page 29)
SHIC's domestic disease monitoring reporting system was developed as the result of a veterinary diagnostic lab (VDL) data standardization project utilizing HL7 messaging. SHIC's support of that work has resulted in a model capturing disease dynamics from daily VDL test results by pathogen over time, specimen, age group, and geographical space. SHIC is now exploring potential expansion of the diagnostic database with USALIMS, an off-the-shelf VDL information management system used in 18 state VDLs, to increase the breadth of producer disease diagnostic inputs and regional disease surveillance.

Global Swine Disease Monitoring Reports (page 30)
The SHIC Global Swine Disease Monitoring Report has provided near real-time information on swine diseases regularly since November 2017 and is communicated to the US pork industry through SHIC's monthly e-newsletter, posting online on the SHIC website, and being published using channels available to authors at the University of Minnesota Department of Veterinary Population Medicine. The project created and now maintains a public, private, academic partnership for its reporting.

Survey Highlights Value of SHIC Disease Monitoring Reports to Swine Industry (page 30)
This summer, SHIC requested industry input about usefulness and enhancements its monthly domestic and global swine disease monitoring reports. Comments and responses to the SHIC survey highlight the broad value and diverse ways in which reports are utilized. Made available through the SHIC e-newsletter and website, the survey covered both SHIC's domestic and global reports, including questions on value, actionable content, use of data, additional pathogens, and opportunities for improvement.

SHIC Reported Information about a "Mystery Swine Disease" in Ecuador (page 31)
ProMED, a program of the International Society for Infectious Diseases, published an article on September 22, 2022, reporting an undiagnosed swine disease in Ecuador. This report stated CSF has been ruled out in the Esmeraldas province after a disease alert was raised on September 7, 2022. In a clarification published subsequently, ProMed reported the samples collected from their unknown disease outbreak are negative for ASF as well. More information SHIC has been able to gather gives added confidence to the report by ProMed.

SHIC Update on ASF Found in Italy / Macedonia and Thailand Report Cases (page 32)
ASF has been diagnosed in Italy. A dead wild boar found in Ovada, in the province of Alessandria, was found to have ASF, per the Italian news wire service ANSA on January 7, 2022, and subsequently confirmed by WOAH, the World Organization for Animal Health. SHIC, American Association of Swine Veterinarians, National Pork Board, and National Pork Producers Council have been gathering information about whether the presence of ASF in Italy, and the response there, could increase risk to the US swine herd or affect the movement of pork products exported from Italy.

According to WOAH, ASF has been found in North Macedonia and the occurrence is not connected to the case in Italy. And while Thailand hadn't officially notified the WOAH of an ASF outbreak, several press reports indicate a case was found in a slaughterhouse.

SHIC Reports on an Australian Outbreak of Japanese Encephalitis Virus in Pigs (page 32)
An active outbreak of mosquito-borne Japanese encephalitis virus (JEV) in pigs in the Australian states of Victoria, Queensland, New South Wales, and South Australia was first reported to the WOAH on March 10. As of that date, 24 swine production sites had been affected. The outbreaks vary from intensive, fully-housed, sow farms to free range farms, with susceptible swine populations on affected sites ranging from five to 100,000 animals.

JEV is also a zoonotic pathogen. It causes an estimated 70,000 cases of viral encephalitis annually, with less than 1% of people infected developing severe disease, but with a 20–30% case fatality rate. The Australian Government/Department of Health is reporting 42 human cases, 32 confirmed and 10 probable. Seven people have been reported to have died as a result of JEV.

SHIC/AASV Webinar Examines JEV Outbreak in Australia and Risk for US Herds (page 33)
On March 29, 2022, the Swine Health Information Center and American Association of Swine Veterinarians hosted a webinar attended by 183 people in 21 countries that was focused on the recent outbreak of Japanese encephalitis virus in pigs and people in Australia. Veterinarians from Australia along with US-based experts shared field experience, epidemiology, and potential risks for transboundary introduction of JEV into the US. The webinar offered a snapshot of the current situation and provided information to improve the identification and management of an unexpected outbreak.

JEV Symposium: Australian Experience Informs US Preparedness (page 33)
As stakeholders in Australia assessed what they know and what they are continuing to learn about the outbreak, international observers are addressing the potential for JEV to be discovered in currently naïve countries, bringing with it challenges to human and animal health. These topics, and others, were

the focus of a recent symposium hosted by the Center for the Ecology of Infectious Disease at the University of Georgia, sponsored primarily by SHIC.

- Mark Schipp, Australia's Chief Veterinary Officer, provided the keynote address for the symposium,
- Drs. Kirsty Richards and Bernie Gleeson with SunPork, an Australian pork production company, reviewed their experiences and learnings.
- David Williams, lead, Diagnosis and Mammalian Infectious Disease Research Group, and colleagues at the Australian Centre for Disease Preparedness, Commonwealth Scientific and Industrial Research Organization, presented the laboratory diagnosis of JEV infections of animals throughout the 2022 outbreak.
- Charles Taylor with the UGA Savannah River Ecology Lab and Warnell School of Forestry and Natural Resources presented information on history, management, and current research on feral pigs in the US.
- Anna Willoughby, a UGA student working with CEID, presented a swine pathogen horizon scan during the JEV Symposium.
- Dr. Michael Neafsey, One Health Coordinator for USDA APHIS, outlined USDA response goals.
- Dr. Natalia Cernicchiaro, Kansas State University, presented a risk assessment of the introduction of JEV in the continental US.

A total of 156 people registered to attend the symposium (27 in-person and 129 virtual attendees) from Australia, Canada, France, Mexico, the Philippines, Singapore, and across the US. Of those, 30 were people with USDA-affiliated agencies.

Post-symposium, SHIC Continues Work on JEV Preparedness and Next Steps (page 35)

Australian retrospective testing shows that JEV was circulating in the country's swine herds for up to a year before the clinical outbreak. Even prior to the outbreak, SHIC had updated its JEV Fact Sheet in 2021 and, post-outbreak, SHIC has already funded an updated, comprehensive entry and establishment risk assessment. Also funded is a complete literature review to ensure the latest information on JEV genotype IV, the genotype causing the Australian outbreak, is available to help develop surveillance, identification, and research.

A JEV research priority list based on the gaps in knowledge identified, including discussions during the symposium, has been drafted. The wide range of impact on the farms – mild to severe clinical outcomes and short to prolonged clinical disease – means that work needs to be done to understand JEV's epidemiology and how on-farm and/or regional factors influence the disease transmission and progression. Also, SHIC has funded a JEV Information Sharing Network website to serve as an information clearinghouse for the global pork and scientific communities.

SHIC Discusses Collaboration Opportunities with FFAR and Australian Organizations (page 35)

Along with the Foundation for Food & Agriculture Research (FFAR), SHIC met and discussed collaborative research opportunities and interests with the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO). The meeting included CSIRO scientists in Biosecurity, Disease

Prevention & Detection, and Invasive Species & Diseases. Collaborative discussions to see if there are common and coordinated research priorities are ongoing.

Customs and Border Protection Metrics and a Reminder to International Travelers: Report Lack of Secondary Screening If Needed (page 35)

When ASF was introduced into China in 2018, Customs and Border Protection was asked how they would be able to measure performance to prevent "ASF fatigue" among their field officers. CBP has started publishing a beginning, transparency "metrics" dashboard on their website. Additional approvals to show agricultural interdictions are promised soon.

SHIC continued to remind all international travelers of the expected protocol when returning to the US after visiting a farm or being in contact with animals in a country (or countries) with ASF, or any other foreign animal disease. These persons should declare this information to US CBP via written form, airport kiosk, or verbally. SHIC, along with the American Association of Swine Veterinarians, National Pork Board, and National Pork Producers Council, continue to ask international travelers to report if they were not diverted for secondary screening upon arrival in the US.

Improve Swine Health Information

ASF Vaccine Status in Vietnam Update (page 36)

In an article published on a Vietnamese agriculture news website during September 2022, positive ASF vaccination results and encouragement for stricter control were shared. Responding to deaths of pigs receiving an ASF vaccine in Binh Dinh, Phu Yen and Quang Ngai provinces, officials determined it was caused by uncontrolled vaccination processes at incorrect ages and dosages that were out of compliance with Ministry guidelines. It was said deaths of post-vaccination pigs could be attributed to the supply and sale of vaccines directly to veterinarians and farmers for self-vaccination.

SHIC-funded Study Looks at Time by Temp Effectiveness in Supply Entry Rooms (page 36)

The temperature and time required to inactivate PRRSV and PEDV on contaminated surfaces commonly found in supply entry rooms on swine farms was evaluated in a study conducted by Dr. Gustavo Silva of Iowa State University and funded by SHIC. This study provides data-driven recommendations for holding times at specific temperatures to reduce the risk of virus introduction at swine farms through contaminated supplies. To reduce the risk of virus introduction through contaminated supplies, recommendations include materials being held at 86°F for at least 24 hours. Another option would be to increase the temperature to at least 104°F, which allows the holding time to be reduced to 12 hours.

SHIC/AASV Webinar Addresses APP Outbreak, Management Strategies (page 37)

With an increase in outbreaks of Actinobacillus pleuropneumoniae (APP) occurring in the Upper Midwest, a webinar was offered by SHIC and the American Association of Swine Veterinarians, hosted by the Iowa State University Swine Medicine Education Center (ISU SMEC), on February 1, 2022. People from the US, Canada, Mexico and 20 other countries heard Drs. Ian Levis, Seaboard Foods, Pete Thomas, Iowa Select Farms, as well as Alyona Michael and Marcelo Almeida, Iowa State University Veterinary Diagnostic Lab share their experiences and diagnostic perspectives.

SHIC APP15 Outbreak Investigation – Preliminary Lab Report (page 38)
In late November 2021, several finisher sites in the upper Midwest began reporting outbreaks of respiratory disease with high mortality. Pigs were exhibiting coughing, high fevers and respiratory distress resulting in death loss of up to 51% within a matter of days post-onset. This outbreak affected upwards of nine otherwise unrelated production systems within a narrow geographic radius. Submissions from affected sites received at Iowa State University Veterinary Diagnostic Lab were diagnosed with Actinobacillus pleuropneumoniae serotype 15 (APP15). SHIC supported additional laboratory analysis of the APP strain involved in the outbreak and Dr. Alyona Michael, ISUVDL, reported preliminary results.

SHIC Co-Sponsoring 2022 NAPRRS Symposium Sessions (page 38)
The North American PRRS Symposium annually brings together members of the swine disease community, including researchers, industry professionals, and field practitioners. Initially driven by PRRS-related concerns, the emergence and spread of new swine viruses, such as PEDV and ASFV, has expanded the Symposium's focus. SHIC is co-sponsoring sessions entitled, "Emerging Diseases and Field Detection" and "Modern Technologies in Swine Disease Diagnostics".

SHIC Serves as a Featured Partner for the Foundation for Food & Agriculture Research (page 39)
Due to SHIC's collaboration with FFAR on the Wean-to-Harvest Biosecurity Program, SHIC was invited to serve as the featured partner of FFAR in the November 2022 edition of the FFAR E-newsletter.

SHIC Invites USDA FADDL Associate Director to Collaborate with US Swine Organizations (page 39)
SHIC invited the newly hired associate director of the Foreign Animal Disease Diagnostic Laboratory (FADDL) to meet virtually with the US swine organizations (SHIC, NPB, AASV, NPPC) for introductions, to discuss synergies and to plan future collaborations.

SHIC Invites USDA Scientists to Present ASFV Vaccine Update to US Swine Organizations (page 39)
SHIC invited USDA ARS principal investigators researching ASFV vaccine development to deliver a virtual presentation to the US swine industry organizations (SHIC, NPB, NPPC, AASV) on December 12, 2022.

SHIC Gives Emerging Disease Presentation During Purina's Swine Summit 2022 (page 39)
Purina held their annual Swine Summit during August in St. Louis, Missouri. SHIC was asked to talk with the invited producer group about SHIC's mission and emerging domestic and international swine diseases.

SHIC Invited to Update Pork Producers on Australian JEV Outbreak During the Missouri Pork Producers Association's Swine Health Symposium and Trade Show (page 39)
During the MPPA's Swine Health Symposium and Trade Show, SHIC gave the attending pork producers and allied industries' representatives an update on the Australian JEV outbreak. "Why U.S. Producers Should Pay Attention to The Down Under" detailed the pig clinical presentation of JEV, the public health impact of the outbreak and the Australian industry and government responses. Included was SHIC's mission of monitoring for emerging swine diseases and acting on behalf of pork producers to help prevent US introduction, enhance preparedness and plan for response.

SHIC Organizes Session at Allen D. Leman Swine Conference on Disease Monitoring (page 40)
SHIC organized and served as a Session Chair at the 2022 Leman Swine Conference on September 19, 2022, in St. Paul, MN for the Session entitled "Actionable monitoring of ASF, PRRS, and other diseases – How to stay up-to-date on what's happening at-home and abroad."

SHIC Invited to Speak About ASF Preparedness at Carthage Veterinary Services Annual Swine Conference and on Iowa Pork Industry Center's SowBridge (page 40)
SHIC was invited to speak to pork producers, academics, Extension personnel, and allied industry audiences about US ASF preparedness and response during the annual CVS Swine Conference and an ISU SowBridge meeting that strives to improve pork industry understanding of important topics.

SHIC Speaks on Transport Biosecurity to USDA ASFV Slaughter Plant Working Group (page 40)
SHIC delivered an invited presentation on transport biosecurity and US truck wash capacity during a virtual meeting of the USDA APHIS ASFV Slaughter Plant Working Group. During the presentation, several of SHIC's disease monitoring and response programs were highlighted.

SHIC Invited to Speak on Disease Monitoring to USAHA Committee on Global Animal Health and Trade (page 40)
On October 11, 2022, SHIC delivered an invited presentation entitled "Overview of SHIC's Global Disease and Health Monitoring" to the Committee on Global Animal Health and Trade at the 126th Annual Meeting of the United States Animal Health Association in Minneapolis, MN.

SHIC Invited to Speak on ASFV projects in Vietnam at McKean Swine Disease Conference (page 40)
SHIC delivered an invited presentation entitled "Building Capacity to Support the Control of African Swine Fever in Vietnam" at the Iowa State University James D. McKean Swine Disease Conference in Ames, IA.

SHIC Invited to Speak on the Gut Microbiome and Respiratory Disease at IPVS in Brazil (page 41)
On June 23, 2022, SHIC delivered an invited presentation as a keynote speaker entitled "Interactions of the gut microbiome and respiratory viruses" at the 26th International Pig Veterinary Society Congress in Rio de Janeiro, Brazil.

SHIC Invited to Speak on ASFV Stability and Detection in Feed at Diagnostics Conference in China (page 41)
SHIC delivered an invited virtual presentation entitled "Stability and detection of African swine fever virus in feed" during the 4th Annual International Veterinary Diagnostics Conference held in Chongqing, China.

SHIC Invited to Speak on the Gut-Lung Axis in Swine Diseases at Production Conference in Brazil (page 41)
SHIC delivered an invited virtual presentation entitled "The gut-lung axis and swine diseases" at the VIII Minas Gerais Symposium of Swine Production and V International Swine Production Conference held in Lavras, Brazil.

Surveillance and Discovery of Emerging Disease

SHIC Collaborates to Collect Data on the Current Use of Oral Fluids in US Swine Herds (page 41)
On October 10, 2022, during USAHA, a meeting was held between USDA APHIS VS and the US swine organizations (SHIC, NPB, AASV, NPPC) to discuss developing swine diagnostic samples and assays. As a follow-up to the meeting, SHIC provided data and figures from the SHIC-funded Swine Disease Reporting System (SDRS) demonstrating that oral fluids are the predominant sample type submitted to VDLs for the testing of five major swine pathogens (PRRSV, PEDV, PDCoV, *Mycoplasma hyopneumoniae*, IAV).

SHIC Looks at Bacterial Spillover Between Species for Potential to Cause Emerging Disease (page 41)
An ongoing collaboration between SHIC and the Center for the Ecology of Infectious Diseases at the University of Georgia has examined spillover risk of bacteria from North American wild mammal species into the US swine herd. This collaboration has resulted in enhanced information needed to prevent, prepare, and respond to emerging diseases and their potential impact on swine health, welfare, and market.

SHIC Investigates Canine Parvovirus 2 for Potential Risk to US Swine (page 42)
Diagnostic laboratory sequencing of lung tissue from a US pig revealed the presence of canine parvovirus 2 (CPV2). The unexpected detection of CPV2 was assumed to be an incidental finding in lung tissue lacking significant lesions and not a contributor to disease. However, since this was the first known detection of CPV2 in swine, SHIC funded research to determine if CPV2 may be an emerging disease risk to US swine.

PCV3 Clinical Sign and Pathology Investigation Informs Case Definition Work (page 42)
A SHIC-funded report evaluating diagnostic data on porcine circovirus type 3 obtained during 2016-2018 by the University of Minnesota Veterinary Diagnostic Lab has been posted. Under the direction of Dr. Albert Rovira, the study objectives were to determine associations between PCV3 presence and quantity with lesions and clinical signs. Results showed PCV3 may cause death in fetuses, myocarditis, and systemic vasculitis in pigs. This data is helping to contribute to an ongoing SHIC-funded study to determine an applicable US case definition.

SHIC Updates PCV3 Fact Sheet and Pursues Case Definition (page 43)
SHIC has updated its porcine circovirus 3 Fact Sheet and begun a project with Iowa State University and the University of Minnesota to investigate historical submissions, tests, and tissues, with their available clinical signalment, to help lead to an applicable US case definition. An analysis of historical submission tests/clinical signs at UMN has already been done and will add to the case definition development. The laboratory analyses will help lead to standardized diagnostic criteria and when the case definition is finalized, on-farm epidemiological work will begin.

SHIC-Funded Morbillivirus Investigation Confirms No US Detection (page 43)
The Iowa State University Veterinary Diagnostic Lab received 22 porcine fetuses from six litters originating in Mexico in the spring of 2020. After extensive testing, metagenomic sequencing identified a new virus in the genus Morbillivirus (porcine morbillivirus or PoMV) from the fetal tissues.

Although PoMV was identified from porcine cases with fetal death, encephalitis, and placentitis, the etiological role of PoMV had not been determined. Further, it was unknown if PoMV was present in the US swine population. Researchers from ISU and the USDA ARS investigated these gaps in knowledge with SHIC funding. There are reports of less well-characterized paramyxoviruses associated with central nervous and respiratory disease in pigs. However, none of these viruses are classified in the genus Morbillivirus.

SHIC Diagnostic Fee Support Program Continues to Offer Additional Resources (page 44)
There is risk of missing an emerging disease if a definitive diagnosis is not reached. In cases of high or ongoing morbidity or mortality, where cause is either not identified or diagnosis is questionable, SHIC offers help to pay for further diagnostic work.

Responding to Emerging Disease

SHIC-funded Project Examines Growing Pig Site Biosecurity Gaps (page 44)
Biosecurity typically focuses most intensely on breeding herd facilities. A group of researchers from Iowa State University, led by Dr. Derald Holtkamp, investigated growing-pig site biosecurity gaps by following PRRS, PEDV and PDCoV infections and investigating a regional Actinobacillus pleuropneumoniae (APP) outbreak.

SHIC Board of Directors Set New Focus on Finishing Phase Biosecurity (page 45)
At their June 29, 2022, meeting, the SHIC Board of Directors voted to proceed with a revision of its 2022 Plan of Work to fund a new program on finishing phase biosecurity in response to disease data from its Swine Disease Reporting System and other recent finishing phase disease outbreak investigations. The new program specifically addresses the finishing phase of swine production, an area where recent data and SHIC Rapid Response Teams' investigations illustrate an ongoing industry vulnerability.

SHIC Initiates Collaboration to Focus on Wean-to-Harvest Biosecurity (page 45)
SHIC is collaborating with the Foundation for Food & Agriculture Research, an organization advancing actionable science to develop tools, technologies, and information benefiting farmers, consumers and the environment, and Pork Checkoff, to fund a Wean-to-Harvest Biosecurity Program to be implemented over the next two years.

SHIC Wean-to-Harvest Biosecurity Program RFPs Released (page 46)
Proposals to investigate cost-effective, innovative technologies, protocols, or ideas to implement biosecurity during the wean-to-harvest phase of production are now being sought. Proactively enhancing wean-to-harvest biosecurity will help control the next emerging disease in the US pork industry and improve US swine herd health, all part of SHIC's mission including analysis of swine health data and targeted research to benefit the US pork industry.

SHIC-Funded Research Questions Feed Role in PDCoV Outbreaks (page 47)
In research funded by SHIC and conducted at Kansas State University, two feed mills and three breed-to-wean facilities diagnosed with porcine deltacoronavirus (PDCoV) were investigated for possible connections related to the outbreak. Initial suspicion was that feed manufacture and delivery

processes were involved in disease transmission. However, this diagnostic investigation did not find evidence within the feed supply chain indicating feed or feed delivery was associated with outbreaks of PDCoV.

SHIC-Funded Characterization of S. zooepidemicus Isolates from Indiana Complete (page 47)

High mortality events due to Streptococcus equi subspecies zooepidemicus in US swine were first reported in Ohio and Tennessee in September and October 2019. In February 2021, two-year-old adult sows from a production system in Indiana experienced increased death loss. To investigate if the Indiana outbreak isolates were similar to or different from isolates from Ohio and Tennessee S. zooepidemicus outbreaks, SHIC-funded whole genome sequencing analysis was performed. The results suggest more than one strain of S. zooepidemicus could cause high mortality events in the United States.

SHIC Rapid Response Teams Stand Ready (page 48)

In response to events following the introduction of PED, SHIC funded Iowa State University to develop the Rapid Response Program (RRP) in August of 2016. The program now includes a nationwide network of individuals called Rapid Response Teams (RRT), who are trained, prepared, and committed to arriving within 72 hours of invitation from pork producers to conduct epidemiological investigations when a new transboundary or emerging disease threat occurs.

During 2022, a transitional Project Coordinator was appointed to provide support to RRT members and assist in conducting outbreak investigations of endemic diseases and to be available in the event of an animal health emergency where the RRT is called upon. The resources used for the Rapid Response Team online training are available for all, regardless of interest in becoming a team member. By registering on the SHIC website, veterinarians can access the training modules which serve as an excellent aid for developing their own rapid response protocol.

Rapid Response Team Investigation Form Refined to be Used as an Industry Standard (page 48)

A working group was formed that reviewed and modified the current Rapid Response Team outbreak investigation form to develop an industry-standard investigation form and reporting instrument that will help assure that the most relevant information is being gathered. The next step, to be completed early in 2023, is to enable on-line entry and logging the data from the investigations in a database that can be analyzed quickly for associations and patterns. The objective is for that analysis to be used for identification of industry-wide biosecurity deficiencies that need improvement to increase the health of the nation's swine herds.

SHIC Participates in the ASF Eradication Whitepaper Tier 1 Review Group (page 49)

The ASF Eradication Whitepaper Tier 1 Review Group is a state-federal-industry collaboration to begin discussion about development of an ASF eradication program in response to a US ASF outbreak. The white paper is outlining factors to consider and potential approaches for developing an eradication program for genotype 2 ASF in the United States. The purpose is to encourage discussion and consideration amongst all stakeholders. Any national eradication plan will be developed and led by APHIS.

Vietnam ASF Research

Introduction (page 49)

With the support of the National Pork Producers Council, in 2019 SHIC was awarded a grant from the USDA-Foreign Agricultural Service to support Vietnam in the prevention and control of ASF through the implementation of a project that builds the capacity of the country's pork production and veterinary workforce.

Section 1: Sharing knowledge and ideas. Strengthening veterinary services' capacity for mitigating ASF's impact on Vietnam (page 50)

This is a capacity-building program to train veterinarians, laboratory workers, and/or farm advisors or managers on methods described by The World Organization for Animal Health (WOAH) as necessary for functional national veterinary services organizations, with a focus on ASF prevention and control.

Section 2: Implementation of field projects, and collection and analysis of samples (page 50)

These field projects were designed to provide valuable biological and epidemiological data about the ASF field situation in Vietnam, during their active ASF outbreak. One goal is to learn real-time lessons about ASF response and control in preparation for responding to and controlling an ASF outbreak in the United States.

Field Projects Completed with Final Reports Received

Potential of Rodents to be a Vector in the Transmission of African Swine Fever on Two Commercial Farms in Vietnam with Differing Biosecurity Levels (page 50)

The first objective was to determine whether rodents trapped in and around ASF-infected farms harbored ASF and, if so, which animal samples are the best ones from which to detect viral infection. The second experiment examined whether rats were susceptible to challenge with ASFV, and, if so, whether they were able to transmit the virus to susceptible rodents. This work on Vietnamese farms with differing biosecurity levels provided information that suggests rodents are not a high risk of being ASF vectors.

Using Standard Laboratory PCR Testing, and Comparing Available POC Technology, to Assess the Validity of Current ASF Test and Remove Practices in Commercial Swine Farms in Vietnam (page 51)

A common "tooth extraction" protocol for a sow farm is to remove any sow exhibiting clinical signs compatible with ASF, plus the four sows (two per stall) in the stalls on the sides of the index (clinical) animal. On 19 (54%) of the 35 farms where the index sow was ASFV PCR positive, removal of the index sow and her direct contact neighbors did not remove all ASFV PCR positive sows identified by sampling.

The second objective was to use the blood samples from the first objective to compare five commercial point of care (POC) assays—two rapid antigen-detection tests (aka "quick tests" (QTs)), POC QT A and QT B and three nucleic acid or PCR assays (POC PCR A, B, and C) against the standard laboratory-based WOAH ASFV PCR (STAND). Compared to STAND, the diagnostic sensitivity and specificity of QT A and QT B were 60% and 88%, and 53% and 74%, respectively. Based on known negative samples, both QT tests were 100% diagnostically specific.

Summary: 1) "Tooth extraction" did not eliminate ASFV from sow farms; 2) ASFV DNA was detected in blood from sows showing no clinical signs; 3) POC tests showed poor diagnostic performance. Limit POC PCR use on clinically ill animals.

ASF Research Projects in Vietnam Examining the Use of Serum and Oral Fluid ELISAs (page 52)
Two separate research projects on ELISAs being conducted in Vietnam continued and provided a final and a preliminary report. The first project is being done by Biostone Animal Health, in collaboration with the Canadian Food Inspection Agency's (CFIA's) National Centre for Foreign Animal Disease (NCFAD). Another ELISA-based study evaluated the performance of ASF serum and/or oral fluid ELISAs for use in the surveillance and monitoring of ASF outbreaks on commercial farms in Vietnam and in preparation for the virus becoming endemic in the United States. This study shows there is no single best diagnostic approach for ASFV surveillance and demonstrates that the combined use of the Tetracore qPCR and indirect ELISA tests and serum/oral fluid sampling increase efficiency of ASF disease surveillance.

Determining the Pathways for ASF Introduction into Boar Studs and Risk of ASF Transmission via Semen Movements During an ASF Outbreak (page 52)
The overall objective was to determine the risk of introducing ASF to a sow farm as a result of semen movement from apparently healthy boar studs in an ASF disease control area. A proactive risk assessment was performed that looked at the potential risk of semen movements during an outbreak. As a result of subject matter expert meetings and studying the findings from published scientific reports and data from outbreaks in Vietnam, each of the potential introduction pathways were evaluated and assigned a likelihood rank that ranges from negligible to high.

Time and Temperature Required for Complete Inactivation of ASFV (page 53)
The objective of this project was to determine the optimal baking time and temperature required to completely inactivate ASFV in aluminum-surface-contaminated swine feces. Specifically, this project tested the effectiveness of the use of thermal-assisted drying and decontamination (TADD), which commonly operates at the temperature between 63°C and 71°C. Three cleaning protocols were used: baking contaminated trays without additional cleaning, power washing the tray surface with water at room temperature prior to baking, and power washing the tray surface with water, followed by applying a disinfectant prior to baking. Incubation of ASFV-contaminated feces at 54°C for 10 minutes was not effective to completely inactivate the virus.

Evaluating the Diagnostic Performance of Pen-Side Tests for ASF Detection (page 54)
Objectives of this project are to determine the time from infection to the earliest detection of the pen-side tests and to determine the sensitivity and specificity of the pen-side tests for detection of ASF in the field. In this study, performance of three pen-side tests for ASFV detection, one PCR test for detection of viral genomic DNA and two lateral flow tests for detection of viral antigens, were evaluated. The results of this study show that the PCR pen-side test has better performance than the antigen test, as it can detect infected pigs earlier and for a longer duration after infection than the antigen test. In addition, the pen-side PCR test works with whole blood and oral swabs, while the antigen test works only with whole blood.

Field Projects Still to be Completed

Field Evaluation of Oral Fluids as a Convenient, Aggregate Sample for Detection of ASF (page 54)
The objective of this project is to conduct a field evaluation of oral fluids in Vietnam for early detection of ASFV. A total of 113 oral fluid samples were collected among four pens on a farm early in an ASF outbreak. Because the testing team cannot travel to Vietnam for sample testing, the collected samples are being prepared for shipment to CIFA's NCFAD for testing. The project timeline was significantly shifted due to Vietnam COVID-19-related travel restrictions. It was also difficult to find farms that had both early-stage ASF infections and farmers willing to be compensated for the use of their pigs in the project. According to the original proposed plan, a minimum of 500 pigs from at least two ASF-infected farms were to be involved in testing oral fluids. Plans continue to include at least 500 pigs in the project.

Identifying Pathways of Entry of ASFV onto Farms to Enhance Information for Improving Biosecurity in Vietnam (page 55)
Objectives of the project include the use of the Rapid Response investigation form used by the U.S. Rapid Response Teams to investigate ASF pathways onto the farms; to use the Rapid Response investigation form in an electronic format, which can compile the data and provide answers as soon as the data sheet is populated; and to make recommendations for how to mitigate the identified gaps in Vietnamese farm biosecurity and improve the situation on the respective farms. Water sources, feed trucks, replacement breeding animals, semen source and visitors have been identified as highest risk factors or events. The investigation form is being converted so that the data can be collected electronically on a website.

Swine Health Information Center Communications

Many communications tools are employed to disseminate information to stakeholders, including the SHIC website, e-newsletter, articles prepared for partners, news releases, interviews with Drs. Paul Sundberg and Megan Niederwerder, social media, SHIC Talk podcast, and webinar series. SHIC also participates in industry events to provide access to information to the protection of US swine herd health. Google Analytics data on SHIC website traffic are used to measure impact of media efforts.

Activity on www.swinehealth.org (page 55)
The top three pages accessed on SHIC website (January 1-November 20, 2022) with (number of visits) were the Homepage (13,289), Seneca Valley Virus Summary (3,574), and Global Disease Monitoring Reports (3,036). Continuous WordPress and plugin updates were completed and the website content was updated with relevant information.

Website Impact January 1-November 20, 2022; (For comparison, 2021 results are included in parentheses) (page 56)

- Over 30,276 individual sessions (14,775)
- 20,666 separate users (11,952)
- 58,199 total page views (25,663)
- Average of 1.92 pages per session (1.41)

- Average session duration of 1:22 (1:23)
- Top 10 countries
    - 11,095 users were from the USA (5,682)
    - 1,641 users were from Germany (611)
    - 1,043 users were from the United Kingdom (375)
    - 804 users were from Canada (456)
    - 520 users were from India (153)
    - 431 users were from the Philippines (284)
    - 342 users were from Japan (83)
    - 305 users were from Mexico (132)
    - 264 users were from Australia (117)
    - 257 users were from China (194)

Press Releases (page 56)

Six SHIC-specific press releases were issued in 2022.

- New Research Project to Investigate Feed Mill Decontamination in the Event of an ASF Outbreak
- SHIC Announces New Associate Director Megan Niederwerder
- SHIC Sets Focus on Wean-to-Harvest Biosecurity
- Bang and Ruen Join SHIC Board of Directors
- New Research Defines ASFV Stability in Feed Held at Three Storage Temperatures
- SHIC Wean-to-Harvest Biosecurity Program RFPs Released

Press Release Impact (page 57)

Emails were sent to 250 ag news outlets for each press release. Individual emails are sent to the top five pork media editors as well as five 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. So far this year, more than 80 interviews with Drs. Sundberg and Niederwerder have taken place.

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 (page 58)

As of November 20, 2022, content was provided for 48 articles for the AASV weekly e-letter and other partners. Organizations like the US Animal Health Association (USAHA) are using SHIC information gleaned from media and the e-newsletter to share with their audiences. With USAHA, this means distribution to state animal health officials as well as key federal animal health officials.

SHIC e-newsletter (page 59)
In 2022, the monthly SHIC e-newsletter publication schedule continued. The distribution list has grown to over 3,000 subscribers and is consistently updated. "Percent opens" for the e-newsletter was 34.37% (Constant Contact benchmark is 33.4%).

SHIC Talk Podcast (page 60)
In 2022, SHIC Talk episodes continued to be produced. The podcast is hosted by Barb Determan and features guests on "industry chatter" topics. 2022 topics completed to date include the SHIC Wean-to-Harvest Biosecurity Program, an African swine fever update, FAD prevention and feed research, the JEV outbreak in Australia and biosecurity. SHIC Talk is available on the SHIC website as well as Apple Podcasts, Google Podcasts, Spotify, Amazon Music/Audible, TuneIn/Alexa, and iHeart Radio.

Webinars (page 60)
SHIC offered a series of webinars with co-sponsor the American Association of Swine Veterinarians in 2022. The quarterly webinars respond to "industry chatter" about current swine health issues. The webinars are conducted by Iowa State University Swine Medicine Education Center staff. Webinar topics as of November 20, 2022 were APP incidence and management, Australia's JEV outbreak and undiagnosed respiratory disease.

Swine Health Information Center 2022 Progress Report

Swine Health Information Center Organization

1) The Swine Health Information Center is a 501(c)(3) corporation governed by a Board of Directors. The producer members of the Board of Directors are active pork producers or representatives of pork producing companies or allied industry that have an interest in the mission of the Center and that serve as champions for the Center's objectives and goals.

   The Swine Health Information Center welcomed two new board members during their meeting held on June 29, 2022. Kent Bang, Bang Ag Consulting, LLC, Omaha, Nebraska, and Paul Ruen, DVM, partner in Fairmont (MN) Veterinary Clinic, began their terms. Founding board members Matt Anderson, DVM, an owner of Suidae Health and Production, Algona, Iowa, and Mark Greenwood, formerly with Compeer Financial, Mankato, Minnesota, concluded their service.

   The new SHIC Board of Directors held election of officers. Daryl Olsen, DVM, AMVC of Audubon, Iowa, was chosen to continue leading the SHIC Board as its president. Howard Hill, DVM, Ames, Iowa, was tabbed to remain vice president for the organization and Bang will serve as secretary/treasurer.

   Currently there are nine members of the Board of Directors:
   a. Two named by the National Pork Board
      i. Gene Noem, Director, Genus PLC, and pork producer, Iowa
      ii. Dr. Russ Nugent, Co-owner of Dogwood Ag Services, LLC, Arkansas
   b. Two named by the National Pork Producers Council
      i. Dr. Howard Hill, NPPC past-president and pork producer, Iowa
      ii. Dr. Jeremy Pittman, Smithfield Hog Production, North Carolina
   c. Two named by the American Association of Swine Veterinarians
      i. Dr. Paul Ruen, Fairmont Veterinary Clinic and AASV past-president, Minnesota
      ii. Dr. Daryl Olsen, AMVC and AASV past-president, Iowa
   d. Three at-large producer members
      i. Mark Schwartz, pork producer, Minnesota
      ii. Dr. Matthew Turner, JBS USA, Colorado
      iii. Kent Bang, Bang Ag Consulting/Compeer Financial-retired, Nebraska

2) A 2022 operating budget and investment portfolio was developed.

The SHIC Board of Directors approved an operating budget for 2022 and has reviewed and modified the budget during the year to best meet the SHIC mission.

Extra funds not needed for the operating budget were invested in securities with Wells Fargo Bank 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.

3) SHIC Working Groups have been formed to provide input and oversight as the Center fulfills its mission.

The Working Groups give the opportunity to provide program oversight and decision-making, supplemented and informed by subject matter expertise. To complete the SHIC Plan of Work, two working groups have been formed.

The Monitoring and Analysis Working Group is charged with assessing foreign, 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 Swine Bacterial Disease Matrix. It is also responsible for improving the health of the nation's swine herd through the development and oversight of on-going projects. These include monitoring for domestic diseases affecting swine health and analyzing health and other data to support on-farm and prospective producer decision making. The Working Group reviews and selects research and program activities that address its Plan of Work.

The Preparedness and Response Working Group is responsible for oversight of the swine viral and bacterial disease matrices research. It is responsible for funding decisions to fulfill other matrices-related research objectives. It also provides advice and oversight of SHIC's role in the emerging swine diseases response plan. That includes the appropriate SHIC response to an emerging swine disease and for the information and analysis necessary to support the proportional pork producer and pork industry response to these emerging diseases. The Working Group reviews and selects research and program activities that address its Plan of Work.

4) A contract with the National Pork Board has extended Pork Checkoff funding of SHIC through 2027.

When the Swine Health Information Center (SHIC) was formed July 1, 2015, by a grant from the National Pork Board, it was with the understanding 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." In December 2021, National Pork Board announced an additional $15 million investment of Pork Checkoff funds in the Swine Health Information Center, extending funding for the center through 2027.

5) SHIC Adds an Associate Director to the Staff

SHIC announced Megan Niederwerder, DVM, PhD, has been chosen for the new role of associate director. Most recently an assistant professor in the Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine at Kansas State University, Niederwerder started April 1 with SHIC.

Specifically, Niederwerder assists Sundberg in directing overall expectations and accountability as well as ensuring quality programs and services. This includes collaborating to provide oversight and implementation of the Center's budget, long range planning, and strategic initiatives. Additionally, Niederwerder interacts closely with the pork community, assisting efforts to build awareness of SHIC, establish and maintain working relationships in the pork industry, and successfully meet the Center's mission.

Swine Health Information Center 2022 Outreach

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. The feedback has helped to focus and refine SHIC responsibilities, research, and programs. Following is a list of organizations and meetings where SHIC's research and programs were presented or discussed.

a. Pork producers
    i. A partial list of producers/companies: AMVC Swine Health Services; Brenneman Pork, Carthage Veterinary Service; Christensen Farms; JBS; The Maschoff's; Iowa Select Farms; Pipestone; Pork Veterinary Solutions, Prestage Farms; Schwartz Farms; Seaboard Foods; Smithfield Foods, Hog Production Division; Suidae Health and Production; Swine Vet Center; 21st Century Strategic Forums, 21st Century Pork Club
    ii. Iowa State University Pork Industry Center
    iii. State Pork Associations
    iv. NPB's Board of Directors, ASF Task Force, Surveillance Research Task Force
    v. NPB/AASV Depopulation Working Group
    vi. National Pork Producers Council's Animal Health and Food Security Policy Committee
    vii. UMN Allen D. Leman Swine Conference
    viii. US SHIC Feed Safety Working Group
    ix. US SHIP Advisory Council
b. Allied industry
    i. Advanced Animal Diagnostics
    ii. American Feed Industry Association
    iii. Antitox Corporation
    iv. APC Swine Advisory Group
    v. Aptimunne Biologics
    vi. Biostrap, Inc.
    vii. Boehringer Ingelheim Vetmedica
    viii. IDEXX
    ix. Institute for Feed Education and Research
    x. Gate Scientific
    xi. Kemin Industries
    xii. Merck Animal Health
    xiii. National Association of Farm Broadcasters
    xiv. National Coalition for Food and Agriculture Research
    xv. National Grain and Feed Association
    xvi. North American Meat Institute
    xvii. Purina Mills
    xviii. Tetracore, Inc.
    xix. Thermo Fisher Scientific
    xx. United Soybean Board

xxi. Zoetis

c. Veterinarians
   i. 2022 AASV annual meeting
   ii. AASV Board of Directors meetings
   iii. Swine Medicine Education Center, Iowa State University
d. US Animal Health Association, including allied industry, USDA and State Animal Health Officials
   i. Swine Health Committee
   ii. Global Animal Health and Trade Committee
e. Veterinary Diagnostic Laboratories, Colleges of Veterinary Medicine, and Academics
   i. Foundation for Food & Agriculture Research
   ii. Kansas State University Department of Diagnostic Medicine/Pathobiology
   iii. Kansas State University Division of Biology
   iv. Iowa State University Veterinary Diagnostic Laboratory
   v. Iowa State University Veterinary Diagnostic and Production Animal Medicine
   vi. Ohio Animal Disease and Diagnostic Laboratory, Ohio State University
   vii. South Dakota State University Veterinary Diagnostic Laboratory
   viii. Texas A&M University Institute for Infectious Animal Diseases
   ix. University of Arizona College of Veterinary Medicine
   x. University of Minnesota Veterinary Diagnostic Laboratory
   xi. University of Saskatchewan Western College of Veterinary Medicine
   xii. University of Texas Medical Branch
f. State Animal Health Officials
   i. Numerous State Veterinarians/State Animal Health Officials
   ii. SAHO ASF Working Group
g. US Centers for Disease Control and Prevention
   i. Centers for Disease Control and Prevention Arboviral Diseases Branch Division of Vector-Borne Diseases
h. US Department of Agriculture
   i. USDA Ag Research Services Director
   ii. USDA Ag Research Services Foreign Arthropod Borne Animal Disease Research Unit
   iii. USDA Ag Research Services Plum Island Animal Disease Center
   iv. USDA Ag Research Services Virus Prion Research Unit
   v. USDA Animal and Plant Health Inspection Service (APHIS), Administrator
   vi. USDA APHIS ASF Technical Working Group
   vii. USDA APHIS ASF Packing Plant Technical Working Group
   viii. USDA APHIS, Deputy Administrator, Veterinary Services
   ix. USDA APHIS Division of Agricultural Select Agents and Toxins
   x. USDA APHIS National Veterinary Stockpile
   xi. USDA APHIS One Health Coordination
   xii. USDA APHIS Trade Sector
   xiii. USDA APHIS Veterinary Services Leadership Team and Veterinary Services staff
   xiv. USDA Center for Epidemiology and Animal Health
   xv. USDA Center for Veterinary Biologics
   xvi. USDA National Animal Health Laboratory Network

xvii. USDA National Import Export Services
xviii. USDA National Institute of Food and Agriculture Tactical Sciences for Agricultural Biosecurity
xix. USDA National Institute of Food and Agriculture Animal Health and Disease
xx. USDA National Wildlife Services
xxi. USDA National Veterinary Services Laboratory, Foreign Animal Disease Diagnostic Laboratory

i. US Department of Homeland Security
    i. Customs and Border Protection
    ii. Science & Technology Directorate
j. US Food and Drug Administration
    i. US Food and Drug Administration Center for Veterinary Medicine Office of Research Division of Animal and Food Microbiology
k. International
    i. Animal Nutrition Association of Canada
    ii. Canadian Food Inspection Agency
    iii. Canadian Innovation Pork
    iv. Canadian Pork Producers Association
    v. Canadian West Swine Health Intelligence Network
    vi. Ontario Animal Health Network
    vii. US Delegation, WOAH, World Organization for Animal Health
    viii. National Service of Agrifood Health, Safety and Quality (SENASICA), Mexico

SHIC Served as Stakeholder Reviewer to USDA-ARS Search for Influenza Research Scientist

SHIC was on an interview panel to give input to the selection of a research microbiologist in the USDA-Ag Research Service Virus and Prion Research Unit, located in Ames, IA. The panel was made up of ARS scientists and staff plus one pork-industry stakeholder representative.

The position is a Research Veterinary Medical Officer/Research Microbiologist/Immunologist in the Intervention Strategies to Control Endemic, and New and Emerging Influenza A Virus Infections in Swine research project, Virus and Prion Research Unit (VPRU), National Animal Disease Center (NADC), Ames, Iowa. The scientist is responsible for identifying and proposing productive research areas, performing independent research, and collaborating with scientists from within the ARS and from academia and private industry to best achieve the research objectives. The focus of the research is to investigate the immunology and mechanisms of influenza A virus (IAV) pathogenesis, host adaptation to swine, and host-pathogen interactions at cellular or molecular levels.

Progress on the Swine Health Information Center 2022 Plan of Work

Preparedness

SHIC Awarded $650K Grant from USDA NIFA to Investigate ASFV Stability in Soybean Products

SHIC was awarded a $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 4-year 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 collaborating with DHS on the procedures to complete the objectives.

SHIC Collaborates on Initiation of North American Swine Veterinarians Meetings

During a meeting between SHIC and the Canadian Pork Council (CPC) on May 18, 2022, discussions occurred on similar ASFV issues and research topics. SHIC and CPC agreed that regular meetings between the North American swine veterinarians (US, Canada, Mexico) would be helpful for discussing ASFV and other issues affecting North American swine. SHIC discussed this with the US pork organizations (NPB, NPPC, AASV) and collaborated with NPPC to move this effort forward and initiate regular meetings. The North American Swine Veterinarians (US, Canada, Mexico) have met once (September 16, 2022) and have a second meeting scheduled (December 9, 2022). NPPC now leads coordination of meetings, which are planned to continue quarterly.

SHIC-Funded Project Looking at Vehicle Networks and Disease Dissemination

Work being conducted by Dr. Gustavo Machado and colleagues at North Carolina State University seeks to determine between-farm contact networks formed by different vehicle movements. The team has developed a novel model to reconstruct vehicle movement networks. Ongoing work will identify the vehicles that create more connections among the farms and consequently may play a role as disease super-spreaders in the network.

To date, the research team has collected GPS movements from 567 different vehicles from three commercial swine companies in two different regions in the US. Each vehicle was labeled according to

its main transportation role. In addition, for 6393 farms used in this study, they collected Secure Pork Supply maps from the biosecurity plans available to identify distance between vehicles and perimeter buffer areas, thus enabling them to define when a vehicle is contacting a farm. They are in the process of creating the network structure to evaluate the connection among farms.

As part of the study objectives, the team is modeling potential spread of African swine fever by creating temporal ranges for the pathogen's stability and potential introduction into susceptible farms. Using published literature about ASF stability in the environment, the model also evaluates probable vehicle cleaning effectiveness within the vehicle movement network.

SHIC-Funded Study Looks to Other Industries for Infectious Aerosol Biocontainment Ideas

A project funded in 2021 to evaluate technologies to prevent the spread of infectious bioaerosols has made progress. Led by Dr. Montse Torremorell at the University of Minnesota, the project is identifying existing and emerging technologies across different industries for their ability to contain bioaerosols in the face of swine disease outbreaks. Next steps will be to research feasibility and cost effectiveness of potential biocontainment technologies.

Currently the group is writing a report on the technologies to be considered for their implementation in agricultural settings. Technologies identified thus far include fibrous filtration, ionization, bipolar ionization, ultraviolet light type C, ultraviolet light type A, electrostatic precipitation, microwave, photo electrochemical oxidation, non-thermal plasmas, and air filters coated with antimicrobial materials.

In addition to the completed work, the project will also provide a cost-benefit and feasibility analysis on identified technologies. This portion of the study will also examine procedures for technologies' application to swine farms for short- and long-term development. Additionally, investigators will assess a subset of technologies for their capabilities to biocontain viruses with different transmission routes and biological characteristics.

Research Defines African Swine Fever Virus Stability in Feed Held at Three Storage Temperatures

A new publication in the journal Transboundary and Emerging Diseases entitled "Stability of African swine fever virus in feed during environmental storage" details the length of time ASFV remains stable in feed at different storage temperatures. The robust study was conducted by a research team at Kansas State University led by Dr. Megan Niederwerder, now Associate Director of the Swine Health Information Center.

In the published study, the stability of ASFV Georgia 2007 was determined in three feed matrices, including complete feed, soybean meal, and ground corncob particles. After ASFV contamination, feed matrices were held at three environmental temperatures (cool storage at 40°F, ambient storage at 68°F, and hot storage at 95°F) for up to 365 days. Feed samples were tested throughout the 1-year period for ASFV genome detection on PCR and ASFV infectivity on cell culture and in swine bioassay.

Results demonstrate high stability of ASFV DNA in feed, with detection by PCR in almost all feed matrices throughout the conclusion of each study, including 365 days after ASFV inoculation when stored at 40°F and 68°F. Infectious ASFV was most stable in soybean meal, with the virus maintaining infectivity as determined by swine bioassay for at least 112 days at 40°F, at least 21 days at 68°F, and at least 7 days at 95°F.

Research was supported by funding from the National Pork Board and the Foundation for Food and Agriculture Research, the State of Kansas National Bio and Agro-defense Facility Fund, Purina Animal Nutrition, Cargill Animal Nutrition, and Kemin Industries.

Study on Feed Goes Beyond Mathematical Half-life Calculations

SHIC funded a study on time by temperature risk mitigation practices in feed storage. For the first time, scientifically sound data based on the use of infectious agents and representative conditions are available to inform the industry on how long, and at what temperature, to store feed and feed ingredients to minimize risk. Previous storage periods for feed were based only on mathematical half-life calculations, not controlled studies using live pathogens and representative conditions.

Per the study summary, viruses of veterinary significance, such as African swine fever virus (ASFv), foot-and-mouth disease virus (FMDv), pseudorabies virus (PRV), and classical swine fever virus (CSFv) are known to survive for extended periods in plant-based feed ingredients. These types of feed ingredients are commonly imported into North America. High risk ingredients, such as oil seed meals, can be stored in designated facilities for extended periods under controlled environmental conditions to minimize viral infectivity prior to use. The results from this study, conducted by Dr. Scott Dee of Pipestone Research, suggest that a storage period of 30-days at a temperature of 23.9° C (75° F) is required to reduce virus infectivity in plant-based feed ingredients such as soybean meal. This information will enhance the application and efficacy of responsible imports protocols to manage the global risk of feed.

SHIC Collaborates with DHS on NPB Grant Investigating ASFV Stability in Fecal Slurry

SHIC assisted NPB in the transfer of a $370K grant to the US Department of Homeland Security Science and Technology Directorate entitled “Characterizing survival and transmission of African swine fever virus in fecal slurry.” Further, SHIC collaborated with DHS on project objectives and procedures to achieve these objectives, discussed standard operating protocols for research objectives, and provided fecal slurry and diagnostic assay materials for experimental studies.

Monitor and Mitigate Risk to Swine Health

SHIC/AASV Webinar Addresses Undiagnosed Respiratory Disease Pursuit and Sampling

Undiagnosed Respiratory Disease: How to Sample for Success and What’s New, an “industry chatter” webinar presented by SHIC and AASV, included viewpoints of the practitioner, diagnostician, and pathologists all seeking answers to ongoing respiratory issues. The webinar was attended by 149 people from 23 countries.

Diagnoses of porcine astrovirus 4 and porcine hemagglutinating encephalomyelitis virus resulted from the pursuit of a diagnosis when more common viruses were ruled out. While unlimited resources for testing and diagnosis would be ideal for identifying root causes of respiratory issues not identified as common viruses, it is unrealistic per the participants in the webinar. However, knowing unresolved respiratory issues could be PAstV4 or porcine hemagglutinating encephalomyelitis virus expand the scope of diagnostic possibilities.

SHIC Joins NPPC Swine Veterinarian Trip to Puerto Rico

SHIC joined a group of 15 US-based veterinarians on a learning trip to San Juan, Puerto Rico, in late August. The tour, organized and led by NPPC, provided first-hand observations of the current ASFV prevention and surveillance programs on the island just 80 miles from the Dominican Republic where ASF is an ongoing risk and challenge. Traveling to Puerto Rico to see the day-to-day work of USDA and CBP provided the veterinarian team with valuable first-hand experience on the ASFV prevention efforts in the Caribbean.

Trip participants learned about diagnostic surveillance of wild and domestic pigs in Puerto Rico from USDA Veterinary Services and had the opportunity to tour the veterinary diagnostic laboratory. Their agenda also included observation of wild pig trapping and transport efforts on the island with USDA Wildlife Services. In addition, representatives from the USDA Plant Protection and Quarantine (PPQ) Program met with the US veterinary delegation who also heard from Puerto Rico's Secretary of Agriculture.

Due to regular travel of ferries between Puerto Rico and the Dominican Republic, the veterinarians visited a ferry terminal where they learned about the efforts of US Customs and Border Protection to prevent entry of ASFV through contaminated pork products. From there, they toured PPQ pre-clearance at the airport where passenger luggage destined for US mainland undergoes inspection for pork by USDA. Both CBP and USDA had highly trained beagle teams in place to assist with inspecting cargo and passengers for prohibited pork products.

SHIC-Funded Project Pursues Disease Warning Tool

In a SHIC-funded effort aimed at increasing swine disease prevention and preparedness, staff with the Morrison Swine Health Monitoring Project are developing a methodology to communicate with project participants whenever a swine disease is occurring in the region near their sites. Whether an endemic or emerging disease, the goal is to be able to quickly report regional status to producers, allowing them to take precautions to protect their herds, per Dr. Mariana Kikuti, researcher, University of Minnesota Department of Veterinary Medicine.

Dr. Kikuti and her colleagues say this project is possible because of MSHMP's primary mission, capturing and analyzing swine health data on a weekly basis from participating farms. Work to take that data and find a useful radius for notifications counting positive sites in a given region is underway. The program has been tested with one company participating in MSHMP, giving researchers a baseline for continued development, beginning with PRRS monitoring and reporting.

When the project is complete, MSHMP will weekly calculate the distance between a site that has recently reported an outbreak and neighboring MSHMP sites. From there, the team will develop a communication system to share regional incidence of disease with participants in a timely fashion, to allow the opportunity to put measures for disease prevention in place. Finally, they will automate the analysis to allow for seamless incorporation of the information for participants followed by open enrollment for non-MSHMP participants once the methodology has been established.

SHIC Funded MSHMP Reports on 2022 Results and Progress

The Morrison Swine Health Monitoring Project (MSHMP), funded primarily by SHIC, helps identify industry needs via input from the project's participants, representing more than 50% of the nation's sow herd, and other sources. MSHMP continues to monitor trends in pathogen incidence and prevalence, including PRRS and the PRRS 1-4-4 L1C variant and data analysis looked at the association of manure pumping activities and PRRS outbreaks as well as helped with outbreak investigations by comparing PRRSv sequences. MSHMP is facilitating sharing of health information by tracking multiple diseases, including transport and health relationships, and is growing by adding boar stud and growing pig data to the sow information already gathered.

Progress included successfully building a system that allows the MSHMP team to quickly understand whether a porcine reproductive and respiratory virus (PRRSv) sequence they receive for review has been identified elsewhere. Another example of progress is the development of PRRS strain analysis or regional heat maps that will enable timely visualization of disease movement or evolution. When cases like a recent concerning PRRS sequence, 1-4-4 Lineage 1C, arise, participants are willing and interested in sharing information, feedback and continue to add more epidemiological information. The project is also working to develop the capability for adding more pathogens to its database.

MSHMP supports monitoring swine disease incidence as a national system in place for emerging pathogen detection, a key element of SHIC's mission. Pig farm population growth, emerging pathogen tool finetuning, transport data usability and platform building for project information sharing are all key areas of action.

SHIC Initiated Swine Disease Reporting System Continues Expanded with IAV-S and PCV2

The Domestic Swine Disease Reporting System, funded by SHIC, collects and disseminates information on endemic and emerging diseases affecting the US swine herd. Following the addition of influenza A virus in swine (IAV-S) in April 2022, porcine circovirus type 2 information was included starting in May 2022, in response to stakeholder requests. Monitoring these two viruses known for different clinical manifestations adds value to SDRS reports while providing needed information for producers and veterinarians.

Tracking IAV-S and PCV2, along with porcine reproductive and respiratory syndrome virus and Mycoplasma hyopneumoniae (MHP), the SDRS now monitors the whole suite of porcine respiratory disease complex. Historical PCV2 data has been fully incorporated and a new page was included in SDRS report #51. Monthly updates about PCV2 DNA detection are now a regular component of SDRS reports and dashboards are also available on the SDRS webpage under the PCV2 detection dashboard.

SDRS, developed in a SHIC-supported collaborative project with data from Iowa State University, University of Minnesota, South Dakota State University, Kansas State University, and Ohio Animal Disease Diagnostic Lab, is currently the only publicly available source of swine health information with all phases of production, including the breeding and grow-finish segments from veterinary diagnostic labs. The SDRS model describes dynamics of disease detection by pathogen over time, specimen, age group, farm type, and geographical space. The report provides benchmark comparison data, providing tools for detecting trends, regionalization, and understanding how to react to outbreaks.

SHIC's Domestic Swine Disease Monitoring Report Renewed for 2023

Since March 2018, SHIC's Domestic Swine Disease Monitoring Report has been published monthly on its website and in its newsletter. Funded by SHIC and produced by the Swine Disease Reporting System team, the report provides real-time updates on megatrends of disease agent activity over time, age group, specimen, and states using data from five midwestern VDLs. During their October board meeting, the SHIC Board of Directors voted to continue funding the program for 2023.

In their renewal proposal, SDRS staff will maintain current aggregated PCR detection databases for PRRSV, PEDV, PDCoV, TGEV, IAV-S, PCV2, and MHP. IAV-S and PCV2 were added to the monitoring report in 2022. In response to a survey conducted by SHIC seeking input for improvements in the SDRS report, educational material with interpretation of reports and charts via short videos will be added in 2023. This digital multimedia content would be featured on the SDRS website and shared via link in reports provided to SHIC.

Both SHIC and SDRS staff maintain focus on reports aligning with SHIC's mission of protecting the health of the US swine herd. Reports share information on the activity of endemic and emerging pathogens affecting the US swine population, assisting veterinarians and producers in making informed decisions on disease prevention, detection, and management.

Rather than anecdotal field observations, this reporting tool provides robust diagnostic data, with statistical analyses and Advisory Group input, that enables early identification and response to emerging and re-emerging diseases in the US swine population. For example, data from the SDRS revealed higher infection rates of pigs post-weaning, a vulnerability that is now being addressed by SHIC's Wean-to-Harvest Biosecurity Program, launched in June 2022.

In addition to publication on the SHIC website and in its newsletter, the SDRS report is available online at the ISU Field Epidemiology page. On this site, the SDRS team maintains a collection of daily updated online dashboards, links to their monthly podcast and YouTube videos, as well as the reports themselves.

SHIC Explores Expansion of Domestic Swine Disease Reporting System

SHIC's domestic disease monitoring reporting system was developed as the result of a veterinary diagnostic lab data standardization project utilizing HL7 messaging. SHIC's support of that work has resulted in a model capturing disease dynamics from daily VDL test results by pathogen over time, specimen, age group, and geographical space. SHIC is now exploring potential expansion of the diagnostic database with USALIMS to increase the breadth of producer disease diagnostic inputs and regional disease surveillance.

USALIMS is an off-the-shelf laboratory information management system available for purchase by VDLs. It is fully integrated with its sibling state animal health official companion system, USAHERDS, providing automated interstate veterinary permit laboratory testing results such as horses negative for equine infectious anemia or streamlining issuance of animal movement permits. Seven states currently use both for that purpose.

Right now, 18 states use USALIMS to record, report, and bill their veterinary diagnostic laboratory results/information, including animal necropsies submitted to them for diagnostic investigations. USALIMS also provides HL7 messaging for the USDA National Animal Health Network laboratories, providing the basic architecture needed to expand to include the messaging structure used by the SDRS.

Global Swine Disease Monitoring Reports

The SHIC Global Swine Disease Monitoring Report has provided near real-time information on swine diseases regularly since November 2017 and is communicated to the US pork industry through SHIC's monthly e-newsletter, posting online on the SHIC website, and being published using channels available to authors at the University of Minnesota Department of Veterinary Population Medicine. The project created and now maintains a public, private, academic partnership for its reporting.

This reporting system identifies hazards and subsequently scores them using a step-wise procedure of screening for issues that potentially represent a risk for the US. 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 USDA-APHIS-CEAH and selected stakeholders, a report describing the outputs has been routinely available to the public. In addition to the three USDA-classified tier 1 reportable foreign animal diseases of swine – ASF, classical swine fever, and foot-and-mouth disease – which represent the main content, reports of significant changes in the epidemiological situation of production diseases such as PRRS or PRV have been included.

The project has been successful in finding and communicating multiple potential threats to the US pork industry. In particular, the project has collaborated with relevant stakeholders in collecting, organizing, critically reviewing, and communicating the expansion of ASF through Asia, Europe and now Hispaniola.

Survey Highlights Value of SHIC Disease Monitoring Reports to Swine Industry

This summer, SHIC requested industry input about usefulness and enhancements to the Center's monthly domestic and global swine disease monitoring reports. Comments and responses to the SHIC survey highlight the broad value and diverse ways in which reports are utilized. Made available through the SHIC e-newsletter and website, the survey covered both SHIC's domestic and global reports, including questions on value, actionable content, use of data, additional pathogens, and opportunities for improvement.

Respondents widely agreed that both reports are valuable, with 100% (domestic) and 91.4% (global) of participants responding yes when asked if the monitoring reports provided valuable information. Examples of comments provided about what was most valuable in the domestic report included "reliable information on time," "keeps me up to date on new threats," "concise report to reference when talking to producers and decision makers regarding domestic disease," and "graphs allow for comparison of my clients' herds to the nation." Similarly, the global report comments on value included "trusted source," "important to understand the movement and changes in global health

issues," "useful as a teaching tool," and "good indication on what disease pressures are around the world."

In addition to value, participants were asked if the reports were used as a tool by providing actionable content which affects their day-to-day decision making. Most respondents agreed, with 75% (domestic) and 55.9% (global) of participants responding they do. Examples of comments provided about what kind of decision-making is affected by the domestic report included "budgeting and forecasting for the business," "if PRRS is trending up in an area, we may do additional testing," "vaccinate or not," "notification of regional risks to clients," "helps me fine tune biosecurity," and "rethink opportunities for area contamination or elimination." Likewise, the global report comments on decisions included "utilize examples from this report to communicate the biosecurity message to producers and decision makers," "is our research focused in right direction for emerging risks," "allows me time to make informed risk management decisions," and "awareness of where ASF is from a travel standpoint."

Beyond decision-making, respondents report using the domestic and global reports for educating stakeholders, staying up to date on diseases affecting production and exports, understanding disease trends regionally and status of national herd, knowing pathogen variants, advising clients and producers, personal education, research purposes, staying up to date on regulatory diseases and reviewing protocols.

SHIC Reported Information about a "Mystery Swine Disease" in Ecuador

ProMED, a program of the International Society for Infectious Diseases, published an article on September 22, 2022, reporting an undiagnosed swine disease in Ecuador. This report stated CSF has been ruled out in the Esmeraldas province after a disease alert was raised on September 7, 2022. No additional alerts had been issued.

The lab at Agrocalidad, Ecuador's agriculture quality assurance agency, tested two dozen samples, subsequently issuing the negative results for CSF. The Ministry of Agriculture and Livestock in Ecuador was engaged and the ProMED report said sites where the undiagnosed disease were located had been visited with sanitary work carried out. In a clarification published subsequently, ProMed reported the samples collected from their unknown disease outbreak are negative for ASF as well. More information SHIC has been able to gather gives added confidence to the report by ProMed.

The "Global Program – Transboundary Animal Diseases" (GF-TADs) is a joint initiative of the WOAH and FAO to help in the fight against the most significant transboundary animal diseases around the world. Because of USDA's continued offer for diagnostic assistance through the Caribbean as well as Central and South America, the GF-TADS became aware of the outbreak and offered additional diagnostic support from laboratories recognized by WOAH for their ability to confidently process diagnostic samples and test for ASF. Subsequent testing confirmed the negative CSF and ASF results.

SHIC Update on ASF Found in Italy / Macedonia and Thailand Report Cases

ASF has been diagnosed in Italy. A dead wild boar found in Ovada, in the province of Alessandria, was found to have ASF, per the Italian news wire service ANSA on January 7, 2022, and subsequently confirmed by WOAH, the World Organization for Animal Health. Since this first ASF diagnosis was reported, others have been found. Per an Italian news report, there were five cases and the number of municipalities in the infected area rose to 114 overall, 78 in Piedmont and 36 in Liguria. These were all included by the Ministry of Health in the ASF control zone as required by European Commission (EC) protocol.

The Swine Health Information Center, American Association of Swine Veterinarians, National Pork Board, and National Pork Producers Council have been gathering information about whether the presence of ASF in Italy, and the response there, could increase risk to the US swine herd or affect the movement of pork products exported from Italy. The US has an agreement with the European Union (EU) to recognize the EU response and the application of control zoning in Italy, as in other affected EU countries. And the zoning and control actions underway in Italy, taken in response to this ASF diagnosis per the EU directive, apply to Member States and third countries, so they apply to products destined for the US.

According to WOAH, ASF has been found in North Macedonia and the occurrence is not connected to the case in Italy. According to the epidemiological investigation, possible entrance of the disease was contact with wild boars. The Food and Veterinary Agency issued a decision on January 7, 2022, regarding protective and control measures. A stamping out policy was carried out among all pig holdings in the 3km area on January 10, 2022.

And while Thailand hasn't officially notified the WOAH of an ASF outbreak, several press reports indicate a case was found in a slaughterhouse. This complex, evolving situation will continue to be closely monitored.

SHIC Reports on an Australian Outbreak of Japanese Encephalitis Virus in Pigs

An active outbreak of mosquito-borne Japanese encephalitis virus (JEV) in pigs in the Australian states of Victoria, Queensland, New South Wales, and South Australia was first reported to the WOAH on March 10. As of that date, 24 swine production sites had been affected. The outbreaks vary from intensive, fully-housed, sow farms to free range farms, with susceptible swine populations on affected sites ranging from five to 100,000 animals.

JEV is also a zoonotic pathogen. It causes an estimated 70,000 cases of viral encephalitis annually, with less than 1% of people infected developing severe disease, but with a 20–30% case fatality rate. As of March 31, the Australian Government/Department of Health is reporting 42 human cases, 32 confirmed and 10 probable. Seven people have been reported to have died as a result of JEV.

Clinical signs have included an increase in stillborn pigs, mummified fetuses, and abortions as well as live pigs born with neurological symptoms including shaking and fine motor tremors. Reports from specific sites include up to a 70% stillborn rate, 50% of sows affected over the last two weeks, and approximately 20% of litters being affected.

JEV is an WOAH-listed disease and must be reported internationally according to the Terrestrial Animal Health Code. Any suspicious clinical or necropsy findings should always be reported to the USDA and the State Animal Health Official. A complete description of JEV in pigs can be found in the SHIC Japanese encephalitis virus fact sheet.

SHIC/AASV Webinar Examines JEV Outbreak in Australia and Risk for US Herds

On March 29, 2022, the Swine Health Information Center and American Association of Swine Veterinarians hosted a webinar attended by 183 people in 21 countries that was focused on the recent outbreak of Japanese encephalitis virus in pigs and people in Australia. Veterinarians from Australia along with US-based experts shared field experience, epidemiology, and potential risks for transboundary introduction of JEV into the US. The webinar offered a snapshot of the current situation and provided information to improve the identification and management of an unexpected outbreak.

Amplification of JEV in swine often precedes human epidemics. It causes an estimated 70,000 cases of viral encephalitis annually, with less than 1% of people infected developing severe disease, but with a 20% to 30% case fatality rate. However, humans are incidental (dead-end) hosts.

JEV Symposium: Australian Experience Informs US Preparedness

The 2022 Japanese encephalitis virus (JEV) outbreak in Australia continues to be at the forefront of producers' minds there and attract attention from around the world. As stakeholders in Australia assess what they know and what they are continuing to learn about the outbreak, international observers are addressing the potential for JEV to be discovered in currently naïve countries, bringing with it challenges to human and animal health. These topics, and others, were the focus of a recent symposium hosted by the Center for the Ecology of Infectious Disease at the University of Georgia, sponsored in part by the Swine Health Information Center. A total 156 people registered to attend the symposium (27 in-person and 129 virtual attendees) from Australia, Canada, France, Mexico, the Philippines, Singapore, and across the US. Of those, 30 were people with USDA-affiliated agencies.

Providing the keynote address for the symposium, Mark Schipp, Australia's Chief Veterinary Officer, shared three ways in which JEV may be identified – animals showing clinical signs, humans showing clinical symptoms, and mosquito surveillance. A total of 84 pork production premises were diagnosed with JEV in eastern Australia during 2022. Interestingly, there appears to be clear alignment with some geography in Australia, i.e., the Murray River.

The diagnosis of JEV in pigs on the eastern side of Australia led to further diagnoses in people and mosquitoes. Data since January 2022 show 32 confirmed cases of JEV in humans with 10 additional probable cases. Only one of those humans had exposure to pigs, per Dr. Schipp. A novel strain of genotype IV of JEV has been sequenced consistently and found to be the causative source of the 2022 outbreak.

Drs. Kirsty Richards and Bernie Gleeson with SunPork, an Australian pork production company, reviewed their experiences and learnings as well during the symposium. The initial indications of JEV on sow farms included delayed farrowing, reduced litter size, increased return to service, late term abortions, mummified, stillborn and shaking piglets. Case studies of four affected Sun Pork herds

demonstrated up to a 9% decrease in pigs weaned. Substantial production and financial costs have occurred due to JEV and an estimated 60% of Australia's pork industry has been impacted, with a reduction of fresh pork supply from August-November this year.

David Williams, lead, Diagnosis and Mammalian Infectious Disease Research Group, and colleagues at the Australian Centre for Disease Preparedness, Commonwealth Scientific and Industrial Research Organization, were heavily involved in the laboratory diagnosis of JEV infections of animals throughout the 2022 outbreak. In addition to human and domestic pig cases detected after the initial 2022 outbreak, active infections were detected in over 50 feral pigs in the Northern Territory of Australia. Several suspected horse cases as well as a single alpaca case were reported.

Whole genome sequences of JEV were contributed from infected domestic and feral pigs, humans and mosquitoes for phylogenetic analyses, which showed no clear geographic, temporal or host relationships between isolates. The data also supported pig movements as unlikely to have played a role in transmission.

Charles Taylor with the UGA Savannah River Ecology Lab and Warnell School of Forestry and Natural Resources presented information on history, management, and current research on feral pigs in the US. As vectors, feral swine are competent for over 45 diseases and parasites, a significant concern for any foreign animal disease including JEV, as demonstrated in Australia.

Anna Willoughby, a UGA student working with CEID presented a swine pathogen horizon scan during the JEV Symposium. In presenting her on-going bacterial spill-over research in mammals, Willoughby said the same approach could be implemented for JEV. It will require revisiting literature to build databases and modeling approaches for all kinds of systems. Success requires knowing details on the life history of the pathogen being examined. Willoughby commented work might be able to pull information from previous West Nile virus outbreaks to apply to JEV work.

Dr. Michael Neafsey, One Health Coordinator for USDA APHIS, outlined USDA response goals which are to detect control and contain FAD outbreaks as quickly as possible, eradicate the FAD using strategies that stabilize animal agriculture, the food supply, the economy, and protect public health and the environment. Goals also include providing science and risk-based approaches and systems to facilitate continuity of business for noninfected animals and noncontaminated animal products.

Dr. Natalia Cernicchiaro, Kansas State University, presented information on the risk of introduction of JEV in the continental US. She noted that the US shares similar climate and environmental conditions. Based on the risk assessment, aircraft and cargo ships were the most likely pathways of JEV introduction via infected adult mosquitoes. The probability of introduction of JEV through infected adult mosquitoes via aircrafts was deemed very high whereas the probability of entry via ships/containers was considered of low to moderate risk. Although the probability of transmission was deemed of variable risk, the probability of JEV establishment in the US is considered negligible. Because of limitations and assumptions made in the initial risk assessment, it is being updated with funding from SHIC.

Post-symposium, SHIC Continues Work on JEV Preparedness and Next Steps

Australian retrospective testing shows that JEV was circulating in the country's swine herds for up to a year before the clinical outbreak. Prior to the outbreak, SHIC updated its JEV Fact Sheet in 2021 and, post-outbreak, SHIC has already funded an updated, comprehensive entry and establishment risk assessment and a complete literature review to ensure the latest information on JEV genotype IV, the genotype causing the Australian outbreak, is available to help develop surveillance, identification, and research.

A JEV research priority list based on the gaps in knowledge identified, including discussions during the symposium, has been drafted. The wide range of impact on the farms – mild to severe clinical outcomes and short to prolonged clinical disease – means that work needs to be done to understand JEV's epidemiology and how on-farm and/or regional factors influence the disease transmission and progression.

Additional areas identified for investigation include oral fluids and barn effluent surveillance, and confirming PCR testing would detect all JEV genotypes, including the genotype responsible for the recent Australian outbreak. Further understanding of the economic and trade impacts of a US JEV incursion to pork producers, as well as identifying competent avian and vector hosts for JEV, will be important. Since JEV is a mosquito disease, investigating effective mosquito control measures on swine farms is also included. As part of this process, SHIC is in communication with Australian veterinarians, producers, and researchers to discuss opportunities for JEV collaboration.

Also, SHIC has entered into a memorandum of understanding with CEID to build a JEV Information Sharing Network website to serve as an information clearinghouse for the global pork and scientific communities. The CEID will fill the website with JEV content with an expected launch in late December 2022 and ongoing content additions occurring in early 2023.

SHIC Discusses International Collaboration Opportunities with FFAR and Australian Organizations

Along with the Foundation for Food & Agriculture Research (FFAR), SHIC met and discussed collaborative opportunities and interests with the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) on July 12, 2022. The meeting included CSIRO scientists in Biosecurity, Disease Prevention & Detection, and Invasive Species & Diseases. A follow up meeting on July 27, 2022, with a goal of aligning biosecurity priorities for North America and Australia, included FFAR, SHIC, CSIRO, and the producer organization Australian Pork. Collaborative discussions to see if there are common and coordinated research priorities are ongoing.

Customs and Border Protection Metrics and a Reminder to International Travelers: Report Lack of Secondary Screening If Needed

When ASF was introduced into China in 2018, Customs and Border Protection was asked how they would be able to measure performance to prevent "ASF fatigue" among their field officers. Subsequent discussions about how SHIC's Swine Disease Reporting System analyzes, and reports, swine disease trends have helped explain how pork industry metrics are applied to show swine disease trends. CBP has started publishing a beginning, transparency "metrics" dashboard on their website. Additional approvals to show agricultural interdictions are promised soon.

SHIC offered a reminder for continued reporting of traveler experiences while going through customs entering the US. A report from international travelers documenting a lack of being diverted to CBP agriculture specialists after they indicated on their Customs form that they had had animal contact at their ASF and FMD endemic destination was sent to CBP. After getting this report, a CBP contact immediately responded saying, "…flights from that area of the world should be a tactical focus and there will be follow up with the agents at that airport."

SHIC continued to remind all international travelers of the expected protocol when returning to the US after visiting a farm or being in contact with animals in a country (or countries) with ASF, or any other foreign animal disease. These persons should declare this information to US CBP via written form, airport kiosk, or verbally. SHIC, along with the American Association of Swine Veterinarians, National Pork Board, and National Pork Producers Council, continue to ask international travelers to report if they were not diverted for secondary screening upon arrival in the US.

Improve Swine Health Information

ASF Vaccine Status in Vietnam Update

In an article published on a Vietnamese agriculture news website during September 2022, positive ASF vaccination results and encouragement for stricter control were shared. Following a vaccination trial performed by the Vietnam Department of Animal Health on two farms with 258 pigs, officials said 20 localities have now deployed vaccinations with a total of more than 21,000 doses following all appropriate guidelines.

A visit to a family farm In Vinh Phuc province by the Deputy Minister of Agriculture and Rural Development and other representatives in early September gave the officials the opportunity for a vaccine trial and observation. On one of the farms where the ASF vaccine was deployed in two rounds, several pigs were noted to have mild fevers but all were stable at the time of the farm visit.

Responding to deaths of pigs receiving an ASF vaccine in Binh Dinh, Phu Yen and Quang Ngai provinces, officials determined it was caused by uncontrolled vaccination processes at incorrect ages and dosages that were out of compliance with Ministry guidelines. It was said deaths of post-vaccination pigs could be attributed to the supply and sale of vaccines directly to veterinarians and farmers for self-vaccination.

As a result of their positive findings in Vinh Phuc province, Ministry officials intend to expand ASF vaccinations soon. Their plans are to deploy up to 600,000 doses. Stricter control of the vaccination process, in accordance with the guidelines of the Ministry, Department of Animal Health instructions, and with the correct vaccination targets will guide the process. Supervision to evaluate effectiveness of the vaccine will continue.

SHIC-funded Study Looks at Time by Temp Effectiveness in Supply Entry Rooms

The temperature and time required to inactivate PRRSV and PEDV on contaminated surfaces commonly found in supply entry rooms on swine farms was evaluated in a study conducted by Dr.

Gustavo Silva of Iowa State University and funded by SHIC. To reduce the risk of virus introduction through contaminated supplies, recommendations include materials being held at 86°F for at least 24 hours. Another option would be to increase the temperature to at least 104°F, which allows the holding time to be reduced to 12 hours.

In this study on time and temperature required for virus inactivation, PRRSV MN184, PRRSV 144 L1C variant, or PEDV were used. Surfaces included diamond plate aluminum and cardboard tested at four temperatures (68°F, 86°F, 104°F and 122°F) with six holding times (15 minutes, 60 minutes, six hours, 12 hours, 24 hours, and 36 hours). Once the surface temperature reached the desired condition, the coupons were held for the designated holding time. Negative controls remained at room temperature for 36 hours and positive controls remained at room temperature for 15 minutes. Three replicates of each treatment were performed and each coupon was inoculated with 2mL of virus or 2mL of media (negative control). Virus titration was performed for each sample after the holding time. Regression models and Weibull curves were built to assess the impact of temperature and time on virus inactivation.

Under the conditions of this study, PRRSV 144 L1C variant was inactivated on aluminum surfaces by heating coupons to 86°F for 12 hours and on cardboard surfaces by heating the coupons to 86°F for six hours. Regarding PRRSV MN184, virus inactivation was possible at 86°F after 24 hours on aluminum and at 104°F after 12 hours on cardboard. PEDV inactivation was achieved at 86°F after six hours on aluminum and at 86°F after 12 hours on cardboard. Virus was inactivated after 15 minutes and one hour at 122°F in aluminum surfaces for PEDV and PRRSV 144 L1C variant, but not for cardboard.

Consequently, this study provides data-driven recommendations for holding times at specific temperatures to reduce the risk of virus introduction at swine farms through contaminated supplies.

SHIC/AASV Webinar Addresses APP Outbreak, Management Strategies

With an increase in outbreaks of Actinobacillus pleuropneumoniae (APP) occurring in the Upper Midwest, a webinar was offered by the SHIC and the American Association of Swine Veterinarians (AASV), hosted by the Iowa State University Swine Medicine Education Center (ISU SMEC), on February 1, 2022. People from the US, Canada, Mexico and 20 other countries heard Drs. Ian Levis, Seaboard Foods, Pete Thomas, Iowa Select Farms, as well as Alyona Michael and Marcelo Almeida, Iowa State University Veterinary Diagnostic Lab share their experiences and diagnostic perspectives.

Multiple practitioners in the field report clinical outbreaks of APP, which have resulted in increased morbidity and mortality across production systems where it was previously well controlled. This SHIC/AASV webinar addressed two practitioners' observations and addressed APP biology, carrier state, transmission, and development of clinical disease, pathogenesis, as well as serotypes and toxins. They shared diagnostic considerations describing the outbreak, general work up results from recent cases, a historical perspective based on ISU VDL serotypes, and the present outbreak of serotype 15. They also shared perspectives on surveillance and monitoring.

SHIC APP15 Outbreak Investigation – Preliminary Lab Report

In late November 2021, several finisher sites in the upper Midwest began reporting outbreaks of respiratory disease with high mortality. Pigs were exhibiting coughing, high fevers and respiratory distress resulting in death loss of up to 51% within a matter of days post-onset. This outbreak affected upwards of nine otherwise unrelated production systems within a narrow geographic radius. Submissions from affected sites received at Iowa State University Veterinary Diagnostic Lab (ISUVDL) were diagnosed with Actinobacillus pleuropneumoniae serotype 15 (APP15). SHIC supported additional laboratory analysis of the APP strain involved in the outbreak and Dr. Alyona Michael, ISUVDL, reported preliminary results.

This APP15 outbreak is highly unusual in several respects: 1) the relative rarity of APP15 isolation in the United States, 2) the unusually high mortality for this strain in the US, and 3) epidemiologic evidence of a high rate of lateral transmission between systems within a narrow geographic radius.

Once the nature and impact of this outbreak were identified, ISUVDL, with funding support from SHIC, rapidly mobilized a tripartite investigatory effort with the following components:

1) Field-based epidemiologic investigation to characterize outbreak dynamics
2) Expansion of ISUVDL in-house serotyping capabilities to expedite both retro- and prospective identification of APP15 in ISUVDL submissions
3) Genetic characterization of APP15 strains recovered from affected sites with comparison to historic isolates

Laboratory work was centered on screening for any genetic shifts in virulence factors that might account for both the high pathogenicity and propensity for lateral transmission of APP15. Preliminary genetic sequencing was performed to characterize primary virulence factors, antibiotic resistance genes, and approximate genetic identity between APP isolates from affected herds. Analysis thus far has confirmed a high degree of homology between strains from the current outbreak but has yet to identify a common historical ancestor. Previously isolated APP15 strains suspected to be endemic to several Iowa systems appear genetically divergent from outbreak isolates.

SHIC Co-Sponsoring 2022 NAPRRS Symposium Sessions

The North American PRRS Symposium annually brings together members of the swine disease community, including researchers, industry professionals, and field practitioners. Initially driven by PRRS-related concerns, the emergence and spread of new swine viruses, such as PEDV and ASFV, has expanded the Symposium's focus. Emerging and transboundary swine diseases are the topic along with integration with the USDA NC229 multi-state project. The 2022 meeting will be held December 2-4, 2022, at the InterContinental in Chicago.

In the SHIC co-organized session Emerging Diseases and Field Detection, presentations included Emerging Swine Disease Investigation: SHIC Update by Paul Sundberg, SHIC, Global Disease Monitoring for Swine Diseases by Maria Sol Perez Aguirreburualde, University of Minnesota, and Japanese Encephalitis Virus: an Emerging Transboundary Pathogen by Leela Noronha, USDA-ARS.

The second session co-organized by SHIC, Modern Technologies in Swine Disease Diagnostics, began with a presentation on Next Generation of Swine Diagnostic Laboratory Platforms by Luis Gimenez-Lirola, Iowa State University, followed by Development of a Single, Rapid Workflow for Simultaneous Detection of >50 Swine Viruses from Field Samples presented by Noelle Noyes, University of Minnesota. Then Differentiation of PRRS Vaccine Strains Using Luminex Bead-Based Technology from Jianfa Bai, Kansas State University, and Low-Cost Biosensors for Rapid, On-Chip, On-Site Detection of Swine Respiratory Viruses from Liang Dong, Iowa State University will follow in this session.

SHIC Serves as a Featured Partner for the Foundation for Food & Agriculture Research

Due to SHIC's collaboration with FFAR on the Wean-to-Harvest Biosecurity Program, SHIC was invited to serve as the featured partner of FFAR in the November 2022 edition of the FFAR E-newsletter. This provided FFAR an opportunity to showcase SHIC to an audience of key stakeholders, highlight the value of the partnership between FFAR and SHIC, and feature the Wean-to-Harvest Biosecurity Research Program.

SHIC Invites New USDA FADDL Associate Director to Collaborate with US Swine Organizations

SHIC invited the newly hired associate director of the Foreign Animal Disease Diagnostic Laboratory (FADDL) to meet virtually with the US swine organizations (SHIC, NPB, AASV, NPPC) for introductions, to discuss synergies and to plan future collaborations. Topics included transboundary animal disease preparedness efforts, such as novel diagnostic assays and research on increasing diagnostic testing efficiencies for FAD.

SHIC invites USDA ARS Scientists to Present ASFV Vaccine Update to US Swine Organizations

SHIC invited USDA ARS principal investigators researching ASFV vaccine development to deliver a virtual presentation to the US swine industry organizations (SHIC, NPB, NPPC, AASV) on December 12, 2022. Planned topics include stakeholder updates on novel ASFV vaccine development, continued safety and efficacy testing, and progress on differentiating vaccinated from infected animals.

SHIC Gives Emerging Disease Presentation During Purina's Swine Summit 2022

Purina held their annual Swine Summit during August in St. Louis, Missouri. SHIC was asked to talk with the invited producer group about SHIC's mission and emerging domestic and international swine diseases. The current state of African Swine Fever prevention, preparedness and response, SHIC's monitoring of diseases around the world, SHIC's domestic disease monitoring program and results and the JEV outbreak in Australia were all topics of presentation and discussion.

SHIC Invited to Update Pork Producers on Australian JEV Outbreak During the Missouri Pork Producers Association's Swine Health Symposium and Trade Show

During the MPPA's Swine Health Symposium and Trade Show, SHIC gave the attending pork producers and allied industries' representatives an update on the Australian JEV outbreak. "Why U.S. Producers Should Pay Attention to The Down Under" detailed the pig clinical presentation of JEV, the public health impact of the outbreak and the Australian industry and government responses. Included was SHIC's mission of monitoring for emerging swine diseases and acting on behalf of pork producers to help prevent US introduction, enhance preparedness and plan for response.

SHIC Organizes Session at Allen D. Leman Swine Conference on Disease Monitoring

SHIC organized and served as a Session Chair at the 2022 Leman Swine Conference on September 19, 2022, in St. Paul, MN for the Session entitled "Actionable monitoring of ASF, PRRS, and other diseases – How to stay up-to-date on what's happening at-home and abroad."

SHIC Invited to Speak about ASF Preparedness at Carthage Veterinary Services Annual Swine Conference and on Iowa Pork Industry Center's SowBridge

SHIC was invited to speak to pork producers, academics, Extension personnel, and allied industry audiences about US ASF preparedness and response during two meetings. The annual CVS Swine Conference is an invited educational and trade show put on by the Carthage Veterinary Service. CVS staff, client production staff and client pork producers from across the country attend the Quincy, Illinois meeting. "ASF Update: Vaccine Use, Lessons Learned in Vietnam and Risk from the Dominican Republic (and more)" gave the audience an overview of current ASF-related topics.

"What Will Happen if ASF Comes to the U.S.?" given during the SowBridge presentation explained the initial industry-wide movement standstill, setting control areas, the Secure Pork Supply and AgView, along with the state, federal and industry responsibilities in a response program. SowBridge strives to improve pork industry understanding of important topics and increase productivity in breeding herds and farrowing systems. Since 2007, the series has reached producers and industry professionals across the U.S. and around the world.

SHIC Speaks on Transport Biosecurity to USDA APHIS ASFV Slaughter Plant Working Group

On November 1, 2022, SHIC delivered an invited presentation on transport biosecurity and US truck wash capacity during a virtual meeting of the USDA APHIS ASFV Slaughter Plant Working Group. During the presentation, several of SHIC's disease monitoring and response programs were highlighted. Further, the Wean-to-Harvest Biosecurity Research Program was described in detail, including the program rationale, partnership with FFAR and NPB, comprehensive biosecurity approach, site and transport task force objectives, and transport research priorities including examples.

SHIC Invited to Speak on Disease Monitoring to USAHA Committee on Global Animal Health and Trade

On October 11, 2022, SHIC delivered an invited presentation entitled "Overview of SHIC's Global Disease and Health Monitoring" to the Committee on Global Animal Health and Trade at the 126th Annual Meeting of the United States Animal Health Association in Minneapolis, MN. An overview was provided for both the Domestic and Global Swine Disease Monitoring Reports with the goal of timely notifications to provide actionable content affecting decision-making of veterinarians and producers.

SHIC Invited to Speak on ASFV projects in Vietnam at McKean Swine Disease Conference

On November 3, 2022, SHIC delivered an invited presentation entitled "Building Capacity to Support the Control of African Swine Fever in Vietnam" at the Iowa State University James D. McKean Swine Disease Conference in Ames, IA. Field investigations were discussed, such as the role of rodents as ASFV vectors, pen-side diagnostic assays and the utility of oral fluids for ASFV diagnostics, risks of ASFV introduction onto farms, and time and temperature necessary for ASFV inactivation. A proceedings paper covering these topics has been published.

SHIC Invited to Speak on the Gut Microbiome and Respiratory Disease at IPVS in Brazil

On June 23, 2022, SHIC delivered an invited presentation as a keynote speaker entitled "Interactions of the gut microbiome and respiratory viruses" at the 26th International Pig Veterinary Society Congress in Rio de Janeiro, Brazil. The role of gut microbiome diversity and composition on clinical and pathologic outcomes of nursery pigs following infection with PRRSV and PCV2 was discussed. A proceedings paper covering this topic has been published.

SHIC Invited to Speak on ASFV Stability and Detection in Feed at Diagnostics Conference in China

On November 14, 2022, SHIC delivered an invited virtual presentation entitled "Stability and detection of African swine fever virus in feed" during the 4th Annual International Veterinary Diagnostics Conference held in Chongqing, China. The presentation covered four objectives, including ASFV stability in transported feed ingredients, ASFV transmission through feed consumption, ASFV detection in contaminated feed, and ASFV risk mitigation of contaminated feed.

SHIC Invited to Speak on the Gut-Lung Axis in Swine Diseases at Production Conference in Brazil

On July 13, 2022, SHIC delivered an invited virtual presentation entitled "The gut-lung axis and swine diseases" at the VIII Minas Gerais Symposium of Swine Production and V International Swine Production Conference held in Lavras, Brazil. After the presentation, SHIC served as a panelist on the roundtable discussion "Nutrition and health against the intestinal microbiota challenges – An international view."

Surveillance and Discovery of Emerging Disease

SHIC Collaborates to Collect Data on the Current Use of Oral Fluids in US Swine Herds

On October 10, 2022, during USAHA, a meeting was held between USDA APHIS VS and the US swine organizations (SHIC, NPB, AASV, NPPC) to discuss developing swine diagnostic samples and assays. As a follow-up to the meeting, SHIC provided data and figures from the SHIC-funded Swine Disease Reporting System (SDRS) demonstrating that oral fluids are the predominant sample type submitted to VDLs for the testing of five major swine pathogens (PRRSV, PEDV, PDCoV, Mycoplasma hyopneumoniae, IAV). USDA requested additional information on the current protocols for collection and submission of oral fluids on US swine farms. SHIC is collaborating with NPB to generate this data through a survey approach of MSHMP participants and AASV members. Further, SHIC is collaborating with SDRS principal investigators to generate data on the use of oral fluids as a diagnostic sample submitted to VDLs.

SHIC Looks at Bacterial Spillover Between Species for Potential to Cause Emerging Disease

An ongoing collaboration between SHIC and the Center for the Ecology of Infectious Diseases at the University of Georgia has examined spillover risk of bacteria from North American wild mammal species into the US swine herd. Bacteria account for a high degree of morbidity and mortality in swine, causing huge losses to the swine industry and zoonotic risks. Domestic pigs often acquire these pathogens (either directly or indirectly) from wild animals, creating the need for assessments such as these to prioritize bacteria species for targeted prevention strategies. This collaboration has resulted

in enhanced information needed to prevent, prepare, and respond to emerging diseases and their potential impact on swine health, welfare, and market.

The first phase of the project identified 102 bacteria species hosted by 127 North American wild mammal species that have a ≥ 97.1% chance of associating with domestic pigs. These bacteria species were assigned a propensity score based on their predicted ability of spilling over from their wild mammal hosts into domestic swine. A classification of either "novel" or "known" was also assigned based on whether or not these species had a known association with pigs documented in scientific literature.

A survey of subject matter experts was the second phase of the project. The goal of the survey was to rank the 102 bacteria species to assess their potential impact on the swine industry via potential effects on public health, antimicrobial resistance, and swine welfare, production, morbidity, and mortality. A limited number of industry professionals completed the survey and identified 16 bacteria species as being of high impact to the swine industry, four of which are not yet known to infect domestic swine: Anaplasma *bovis* (98.7% modeled chance of spilling over into swine), Clostridium *botulinum* (98.7%), Klebsiella *pneumoniae* (98.6%), and Yersinia *pestis* (99.7%). Additionally, seven bacteria were ranked as having a high-risk of antimicrobial resistance and five bacteria were ranked as having a high human outbreak potential. Results of the analysis uncovered two novel bacteria that are found in pigs, which helps validate the predictive model.

SHIC Investigates Canine Parvovirus 2 for Potential Risk to US Swine

Diagnostic laboratory sequencing of lung tissue from a US pig revealed the presence of canine parvovirus 2 (CPV2). The unexpected detection of CPV2 was assumed to be an incidental finding in lung tissue lacking significant lesions and not a contributor to disease. However, since this was the first known detection of CPV2 in swine, SHIC funded research to determine if CPV2 may be an emerging disease risk to US swine.

First, tissues previously submitted to the diagnostic lab from US swine were screened for the presence of CPV2 genome using PCR. Approximately 13% of tissues had CPV2 detected at relatively low DNA levels (mean Ct = 31). Second, serum samples previously submitted to the diagnostic lab from US swine were screened for the presence of CPV2 antibodies using hemagglutination inhibition assays. Approximately 66% of serum samples had CPV2 antibodies detected at low levels (most titers ≤ 80). Third, colostrum-deprived one day old neonatal pigs were inoculated through the oronasal route with CPV2 to assess their ability to replicate the virus and the ability of CPV2 to induce disease. Experimentally inoculated swine did not appear to develop productive CPV2 infections.

Overall, research determined that although CPV2 is capable of spillover into swine, the virus does not appear to be highly pathogenic to pigs. Continued vigilance of the industry is needed as mutations of CPV2 over time may alter the epidemiological situation and increase the disease risk to US swine.

SHIC-Supported PCV3 Clinical Sign and Pathology Investigation Informs Case Definition Work

A SHIC-funded report evaluating diagnostic data on porcine circovirus type 3 obtained during 2016-2018 by the University of Minnesota Veterinary Diagnostic Lab has been posted. Under the direction of

Dr. Albert Rovira, the study objectives were to determine associations between PCV3 presence and quantity with lesions and clinical signs. Results showed PCV3 may cause death in fetuses, myocarditis, and systemic vasculitis in pigs. This data is helping to contribute to an ongoing SHIC-funded study to determine an applicable US case definition.

In the newly posted Rovira study, the relationship between PCV3 antigen and clinical disease was investigated based on a large dataset of diagnostic cases. PCV3 was detected in approximately 20% of pigs with tissues submitted to the UMN diagnostic laboratory. Samples with the highest PCV3 quantity were detected in fetal lesions of myocarditis and systemic vasculitis. Although no significant associations were identified between PCV3 antigen detection with the clinical description on VDL submissions, there was a significant association between PCV3 presence and heart vasculitis/perivasculitis. In PCV3-positive pigs, higher viral loads were significantly associated with pigs having myocarditis, heart vasculitis/perivasculitis, kidney vasculitis/perivasculitis and dermatitis.

SHIC Updates PCV3 Fact Sheet and Pursues Case Definition

SHIC has updated its porcine circovirus 3 Fact Sheet and begun a project with Iowa State University and the University of Minnesota to investigate historical submissions, tests, and tissues, with their available clinical signalment, to help lead to an applicable US case definition. An analysis of historical submission tests/clinical signs at UMN has already been done and will add to the case definition development. The laboratory analyses will help lead to standardized diagnostic criteria and when the case definition is finalized, on-farm epidemiological work will begin.

PCV3 is an emerging pathogen of swine with potential economic importance, per SHIC's updated PCV3 Fact Sheet. It has been associated with signs similar to those caused by PCV2. However, many infections seem to be subclinical, and PCV3 pathogenicity studies have had mixed results. PCV 3 has been associated with neurological disease, reproductive failure, respiratory disease, enteric disease, and porcine dermatitis and nephropathy syndrome. However, only a few studies have demonstrated the presence of PCV3 in lesions.

SHIC-Funded Morbillivirus Investigation Confirms No US Detection

The Iowa State University Veterinary Diagnostic Lab received 22 porcine fetuses from six litters originating in Mexico in the spring of 2020. After extensive testing, metagenomic sequencing identified a new virus in the genus Morbillivirus (porcine morbillivirus or PoMV) from the fetal tissues. Other currently known members in the genus Morbillivirus, including measles virus, rinderpest virus, peste des petits ruminants virus, canine distemper virus, phocine distemper virus, cetacean morbillivirus, and feline morbillivirus, are highly contagious pathogens and can cause serious human and animal diseases.

Although PoMV was identified from porcine cases with fetal death, encephalitis, and placentitis, the etiological role of PoMV had not been determined. Further, it was unknown if PoMV was present in the US swine population. Researchers from ISU and the USDA ARS investigated these gaps in knowledge with SHIC funding.

Paramyxoviruses that are known to naturally infect swine include porcine rubulavirus, Menangle virus, Nipah virus, and porcine parainfluenza virus. There are reports of less well-characterized paramyxoviruses associated with central nervous and respiratory disease in pigs. However, none of these viruses are classified in the genus Morbillivirus.

SHIC Diagnostic Fee Support Program Continues to Offer Additional Resources

There is risk of missing an emerging disease if a definitive diagnosis is not reached. SHIC's diagnostic fee assistance program was developed after porcine circovirus 2 (PCV2), porcine circovirus associated disease (PCVAD), porcine deltacoronavirus (PDCoV), porcine epidemic diarrhea virus (PEDV), and Senecavirus A (SVA) outbreaks surprised the US pork industry. In cases of high or ongoing morbidity or mortality, where cause is either not identified or diagnosis is questionable, SHIC offers help to pay for further diagnostic work.

To qualify for fee assistance, the diagnostician of the case needs to initiate the process and the following requirements must be met:

- Case involves high or ongoing morbidity or mortality.
- Routine diagnostics matching the clinical presentation have been completed.
- Results of routine diagnostics are unsatisfactory due to veterinarian's clinical judgment or lack of identified cause.

How Does the Process Work?

1. Originating diagnostician will submit the online form to a panel of diagnosticians for review.
2. SHIC will confirm the state animal health officer has been informed and a decision on initiating a foreign animal disease investigation has been considered.
3. Originating diagnostician is responsible for a case record including Submitter Permission Form (forms available here) assuring permission for further testing.
4. A SHIC Diagnostician Panel will contact originating diagnostician within 48 hours then provide a written report of recommendations subsequent to case review.
5. Originating diagnostician provides the Panel report and additional results to submitter and is responsible for generating a final report to submitter, Diagnostician Panel, and SHIC.
6. When the Final Report is accepted, SHIC will send diagnostic fee payment.

Responding to Emerging Disease

SHIC-funded Project Examines Growing Pig Site Biosecurity Gaps

Biosecurity typically focuses most intensely on breeding herd facilities. A group of researchers from Iowa State University, led by Dr. Derald Holtkamp, investigated growing-pig site biosecurity gaps by following PRRS, PEDV and PDCoV infections and investigating a regional Actinobacillus *pleuropneumoniae* (APP) outbreak.

Of the 75 groups of pigs followed from nursery to marketing in the first study, only two stayed negative for PRRSV. All were negative for PRRSV and coronaviruses at placement. Dr. Holtkamp reports there are some interesting patterns in the data and said one thing stands out – how closely correlated the frequency of events (movements, deliveries, maintenance, etc.) are with positive tests for PRRSV,

PEDV, and PDCoV, in both the nursery and finishing phase. While PRRSV outbreaks occurred primarily in the finishing phase after movement, coronavirus (ie., PEDV) positive tests were more frequent in the nursery stage. TGE was never detected in any of the groups.

Other analysis surrounding four groups of pigs known to be negative from the sow farm then tested positive very early points to the nursery barns where they were placed. It was known previous groups in those barns were tested positive – four for PEDV and three for PDCoV. The pigs picked up the viruses either via transport or in facilities not properly washed and disinfected.

SHIC Board of Directors Set New Focus on Finishing Phase Biosecurity

At their June 29, 2022, meeting, the Swine Health Information Center Board of Directors voted to proceed with a revision of its 2022 Plan of Work to fund a new program on finishing phase biosecurity. SHIC's Board approved reallocation of $1 million from the 2022 budget for the program to be developed in response to disease data from its Swine Disease Reporting System and other recent finishing phase disease outbreak investigations. SDRS data is shared monthly with SHIC stakeholders on its website and in its newsletter.

The new program will specifically address the finishing phase of swine production, an area where recent data and SHIC Rapid Response Teams' investigations illustrates an ongoing industry vulnerability. In turn, the vulnerability in the finisher increases disease pressure on the breeding and farrowing phases, where biosecurity measures have historically been focused. Examples cited include: 1) Actinobacillus pleuropneumoniae serotype 15 outbreaks in Iowa-based finishers, 2) evidence of PRRS virus outbreaks in finishers preceding outbreaks in sow barns, and 3) nursery and finisher sites being implicated as sources of increased PED virus outbreaks. This led SHIC to recognize the need for a new focus on the finishing phase of production. The program will concentrate on cost-effective new technologies and research into biocontainment, bioexclusion, and transport biosecurity.

SHIC Initiates Collaboration to Focus on Wean-to-Harvest Biosecurity

SHIC is collaborating with the Foundation for Food & Agriculture Research, an organization advancing actionable science to develop tools, technologies, and information benefiting farmers, consumers and the environment, and Pork Checkoff, to fund a Wean-to-Harvest Biosecurity Program to be implemented over the next two years.

SHIC will contribute $1 million of reallocated funds from its current 2022 budget to the Wean-to-Harvest Biosecurity Program and FFAR will provide $1.15 million towards the effort. The Pork Checkoff is contributing $150,000 as well. By leveraging budget allocation with the matching funds from FFAR and the Checkoff, SHIC increases capacity and output for its mission to safeguard the health of the US swine herd.

As part of the Wean-to-Harvest Biosecurity Program, SHIC established two task forces to develop specific, researchable priorities for the topic areas of transport biosecurity and site bioexclusion and biocontainment. With members from across the pork industry and academia, the Wean-to-Harvest Biosecurity Site Task Force and Wean-to-Harvest Biosecurity Transport Task Force have each met

virtually to discuss priorities and ensure coordination across the pork industry, so there is no overlap in investigations and research providing the greatest return on investment.

During the Wean-to-Harvest Biosecurity Research Program task force work, several research priorities were identified addressing transportation and unloading of pigs at packing plants, secondary markets, or other first points of concentration. Contact with the North American Meat Institute has resulted in interest about collaborating on common processing plant biosecurity research priorities. In November 2022, SHIC toured a major US packing plant to learn about these challenges and discuss possible tools and technologies which may help improve biosecurity during the unloading process and reduce risk to the US swine industry.

SHIC Wean-to-Harvest Biosecurity Program RFPs Released

SHIC, along with the Foundation for Food & Agriculture Research and Pork Checkoff, joined together to fund a Wean-to-Harvest Biosecurity Program to be implemented over the next two years. Proposals to investigate cost-effective, innovative technologies, protocols, or ideas to implement biosecurity during the wean-to-harvest phase of production are now being sought. Proactively enhancing wean-to-harvest biosecurity will help control the next emerging disease in the US pork industry and improve US swine herd health, all part of SHIC's mission including analysis of swine health data and targeted research to benefit the US pork industry.

Site biocontainment and bioexclusion has four priorities:

- Personnel biocontainment and bioexclusion - implementation and compliance incentives; personnel and equipment traceability; alternatives to shower-in/shower-out facilities and protocols; biocontainment or bioexclusion engineering controls; and innovative ways to ensure implementation of protocols and policies.
- Facility biocontainment and bioexclusion – identification of biosecurity-effective and cost-effective options for retrofitting or renovating current production site designs; novel biosecurity-effective and cost-effective methods for preventing aerosolized pathogen introduction; decreasing aerosol pathogen dispersal; and feasibility of scheduling deliveries within networks relative to biosecurity status.
- Site mortalities – investigation of innovative engineering or facility design solutions for preventing pathogen spread through mortality movements; and exploration of containment materials, technologies, and equipment to reduce contamination of the environment.
- Equipment, environmental and supply biocontainment and bioexclusion – investigation of novel, less-labor and less-time intensive technologies and/or protocols for cleaning and disinfection of pens, barns and/or equipment; point-of-care diagnostic assays or other novel contamination sensing technologies; and sampling design for determining if pens, equipment, or supplies are contaminated or disinfected.

Transportation Biosecurity Research Priorities

- Biosecurity of truck driver – identification and mitigation of pathways for pathogen introduction or movement from driver activities; investigation and validation of innovative ways to cost-effectively clean and disinfect nonpig contact areas of the truck; and investigation of innovative facility designs that inherently increase biosecurity during pig loading.

- Efficiency of truck washing – investigation of innovative ideas to increase throughput in truck wash facilities and cost-effective technologies that can be applied to existing trailer designs and configurations to improve ease of cleaning and disinfection; investigation of sampling and testing strategies for tractors and trailers; and new technologies for sensing contamination or measuring effective disinfection of transport equipment.
- Alternatives to fixed truck wash facilities - design or demonstration of deployable techniques for cleaning and disinfection of trucks; mobile systems or temporary structures for interior trailer cleaning and disinfection with and without water.
- Biosecurity at first points of concentration – investigation and validation of innovative techniques and/or technologies that can be applied at the unloading docks at markets, packing plants, and other first points of concentration, including entry and exit to these sites, to decrease the pathogen load and the opportunity for tractors and trailers to transfer pathogens from these facilities back to the farm.

SHIC-Funded Research Questions Feed Role in PDCoV Outbreaks

In research funded by SHIC and conducted at Kansas State University, two feed mills and three breed-to-wean facilities diagnosed with porcine deltacoronavirus (PDCoV) were investigated for possible connections related to the outbreak. Initial suspicion was that feed manufacture and delivery processes were involved in disease transmission. Goals of the research were to understand if the feed mill was the origin of disease and then determine if trucks or people, either coming from the infected farms or coming from the feed mills, served as vectors to spread this virus.

Both feed mills were audited, and environmental samples collected in areas deemed high risk for virus contamination. All breed-to-wean facilities had PDCoV detected as would be expected, while the only positive samples for enteric coronaviruses associated with feed mills were feed delivery trucks.

This diagnostic investigation did not find evidence within the feed supply chain indicating feed or feed delivery was associated with outbreaks of PDCoV. Due to the nature of timing, it is believed that the contamination identified at the infected sites was due to the intentional exposure through controlled oral exposure. Furthermore, it is not known what the specific mechanism of transmission was to these farms, although other routes must be considered such as personnel and other possible fomites such as incoming supplies. The goal of this investigation was to evaluate the likelihood of a link between feed manufacturing and delivery with the outbreak of clinical disease, so greater investigation into potential routes of entry were not explored.

SHIC-Funded Characterization of S. zooepidemicus Isolates from Indiana Complete

High mortality events due to Streptococcus equi subspecies zooepidemicus in US swine were first reported in Ohio and Tennessee in September and October 2019. In February 2021, two-year-old adult sows from a production system in Indiana experienced increased death loss. To investigate if the Indiana outbreak isolates were similar to or different from isolates from Ohio and Tennessee S. zooepidemicus outbreaks, SHIC-funded whole genome sequencing analysis was performed.

In Indiana, there were 66 deaths in the affected 2400-sow production herd within a six-week period. Four outbreak isolates from Indiana were genetically distant to those isolates causing high mortality

events in Ohio and Tennessee in the spring of 2019, while closely related to a S. zooepidemicus isolate from a horse in Iowa. These results suggest more than one strain of S. zooepidemicus could cause high mortality events in the United States.

SHIC Rapid Response Teams Stand Ready

In response to events following the introduction of PED, SHIC funded Iowa State University to develop the Rapid Response Program (RRP) in August of 2016. The program now includes a nationwide network of individuals called the Rapid Response Teams (RRT), who are trained, prepared, and committed to arriving within 72 hours of invitation from pork producers to conduct epidemiological investigations when a new transboundary or emerging disease threat occurs.

During 2022, a transitional Project Coordinator was appointed to provide support to RRT members and assist in conducting outbreak investigations of endemic diseases and to be available in the event of an animal health emergency where the RRT is called upon.

When requested by producers, RRT members were invited to conduct investigations of outbreaks of endemic diseases. The transitional Project Coordinator gathered the information needed to prepare the outbreak investigation form and coordinated the investigations with all the relevant parties. Thirteen investigations of PRRSV, PEDV and APP15 outbreaks were conducted during 2022.

Rapid Response Teams, volunteer groups of specifically-trained industry experts, quickly carry out Rapid Response Program outbreak investigations, analyzing the patterns and pathways of entry for disease-causing pathogens in affected herds. SHIC trains, maintains, and funds the Teams to provide a coordinated industry disease response that can make anonymized recommendations to prevent infection of other swine units. Those recommendations can be rapidly circulated industry wide. Team members update training regularly and remain ready to respond when the need arises.

The resources used for the Rapid Response Team online training are available for all, regardless of interest in becoming a team member. By registering on the SHIC website, veterinarians can access the training modules which serve as an excellent aid for developing their own rapid response protocol.

Rapid Response Team Investigation Form Refined to be Used as an Industry Standard

The SHIC Rapid Response Teams are composed of a nationwide network of veterinarians, state animal health officials or representatives, epidemiologists, and, when appropriate, federal animal health officials who are trained, prepared, and committed to conduct epidemiological investigations when a new transboundary or emerging disease threat occurs. The approach, methodology, forms, and reports for investigating endemic (like PRRS and PED), transboundary and emerging diseases have been developed.

A working group was formed that reviewed and modified the current Rapid Response Team outbreak investigation form to develop an industry-standard investigation form and reporting instrument that will help assure that the most relevant information is being gathered. The next step, to be completed early in 2023, is to enable on-line entry and logging the data from the investigations in a database that can be analyzed quickly for associations and patterns. The objective is for that analysis to be used for

identification of industry-wide biosecurity deficiencies that need improvement to increase the health of the nation's swine herds.

SHIC Participates in the ASF Eradication Whitepaper Tier 1 Review Group

The ASF Eradication Whitepaper Tier 1 Review Group is a state-federal-industry collaboration to begin discussion about development of an ASF eradication program in response to a US ASF outbreak. The white paper is outlining factors to consider and potential approaches for developing an eradication program for genotype 2 ASF in the United States. The purpose is to encourage discussion and consideration amongst all stakeholders. Any national eradication plan will be developed and led by APHIS.

Most ASF preparedness and response information that has been developed focuses on initial introduction, detection, and response. This is entirely appropriate since early detection and an aggressive response provides the best opportunity to eliminate ASF infection in the U.S. However, this white paper assumes ASF has been detected in the US and has not been eradicated after a period of time, despite intensive efforts. It becomes apparent that eradication of ASF in domestic or feral swine, or both, will be a long-term effort.

The components and concepts of the white paper include:

- Review the characteristics of ASF that are important in designing an eradication program.
- ASF vaccine is not anticipated to be available as a tool to assist with eradication in the next few years. When vaccine becomes readily available, the eradication plan can change to incorporate vaccination.
- Compare and contrast with pseudorabies and other eradication programs.
- Review lessons learned from ASF eradication programs and outcomes in other countries.
- Include the importance of keeping packing plants operating at near capacity.
- Design a program that can maintain or re-start some exports if possible according to the 2021 WOAH Terrestrial Animal Health Code, Chapter 15.1, that details free zones, containment zones, and recommendations for importation of fresh meat from countries or zones not free of ASF.

Vietnam ASF Research

Introduction

With the support of the National Pork Producers Council, in 2019 SHIC was awarded a grant from the USDA-Foreign Agricultural Service to support Vietnam in the prevention and control of ASF through the implementation of a project that builds the capacity of the country's pork production and veterinary workforce.

Section 1: Sharing knowledge and ideas. Strengthening veterinary services' capacity for mitigating ASF's impact on Vietnam

This is a capacity-building program to train veterinarians, laboratory workers, and/or farm advisors or managers on methods described by The World Organization for Animal Health (WOAH) as necessary for functional national veterinary services organizations, with a focus on ASF prevention and control. The program was developed by the University of Minnesota Center for Animal Health and Food Safety (CAHFS) and local partners and institutions.

Section 2: Implementation of field projects, and collection and analysis of samples

These field projects were designed to provide valuable biological and epidemiological data about the ASF field situation in Vietnam, during their active ASF outbreak. One goal is to learn real-time lessons about ASF response and control in preparation for responding to and controlling an ASF outbreak in the United States.

A call for proposals was published in the spring of 2020, with project selection happening soon after. The call for proposals asked applicants to describe how they would accomplish the following:

- identifying pathways of viral entry onto the farms, to enhance biosecurity
- validating the use of swine oral fluids to confirm farm positive/negative ASF status (Appropriate sampling frequency and number would be assessed.)
- exploring the potential to isolate the virus to one area of the farm, enabling other areas to continue to provide ASF-free meat
- validating cleaning and disinfection procedures that enable repopulation of the farm as soon as it is safe
- supporting a variety of diagnostic tests that could detect and eliminate ASF

Field Projects Completed with Final Reports Received

Potential of Rodents to be a Vector in the Transmission of African Swine Fever on Two Commercial Farms in Vietnam with Differing Biosecurity Levels

The first objective was to determine whether rodents trapped in and around ASF-infected farms harbored ASFV virus, and, if so, which animal samples are the best ones from which to detect viral infection.

Live traps were placed nightly at each study farm, outside facilities at entry points and inside facilities near feed sources. Trapping continued at each farm for 10 to 36 days or until 10 rats were captured. A total of 34 rats were trapped among the five farms, with two to 10 captured per farm.

Samples from rats in and around farms undergoing ASF outbreaks were negative for ASF across several sample types, in a testing process that examined biological as well as mechanical vector potential. This work suggests that rats (and presumably similar rodents) do not serve as important vectors for ASFV.

Building on the negative results from Experiment 1, the second experiment examined whether rats were susceptible to challenge with ASFV, and, if so, whether they were able to transmit the virus to susceptible rodents.

After they were inoculated, the rats did not show clinical signs of ASFV during the observation periods. There were no differences between the body temperature of control rats and inoculated rats, although temperatures of all rats (control, inoculated, and contacts) climbed during the second week of the experiment, then fell back to baseline.

At each sampling point, blood, spleen, liver, lung, and ileum were polymerase chain reaction (PCR)-tested for ASFV. None of the samples was positive for ASFV. Serum analyses using an ELISA test to detect antibodies were negative for all rats at all collection points. Despite robust challenges, intraperitoneally and orally, rats were not observed to become ill from nor infected with ASFV, out to an incubation period of 21 days.

This work on Vietnamese farms with differing biosecurity levels provided information that suggests rodents are not a high risk of being ASF vectors.

Using Standard Laboratory PCR Testing, and Comparing Available POC Technology, to Assess the Validity of Current ASF Test and Remove Practices in Commercial Swine Farms in Vietnam

The value of pork in Vietnam has increased because supply has decreased; therefore, standard ASFV control measures have centered around a modified "test-and-remove" or "tooth extraction" protocol. A common "tooth extraction" protocol for a sow farm is to remove any sow exhibiting clinical signs compatible with ASF, plus the four sows (two per stall) in the stalls on the sides of the index (clinical) animal.

The first objective was to test the efficacy of the "tooth extraction" protocol for elimination of ASFV from ASF-infected sow farms. On 17 (33%) of the 52 farms with ASF outbreaks, the index sow and 14 neighbor sows were ASFV PCR negative. On 19 (54%) of the 35 farms where the index sow was ASFV PCR positive, removal of the index sow and her direct contact neighbors did not remove all ASFV PCR positive sows identified by sampling.

The second objective was to use the blood samples from the first objective to compare five commercial point of care (POC) assays—two rapid antigen-detection tests (aka "quick tests" (QTs)), POC QT A and QT B and three nucleic acid or PCR assays (POC PCR A, B, and C) against the standard laboratory-based WOAH ASFV PCR (STAND).

Compared to STAND, the three POC PCR performed equally with 84-85% diagnostic sensitivity and 95-98% diagnostic specificity on field samples and 98-100% diagnostic specificity on known negative samples.

Compared to STAND, the diagnostic sensitivity and specificity of QT A and QT B were 60% and 88%, and 53% and 74%, respectively. Based on known negative samples, both QT tests were 100% diagnostically specific.

Summary: 1) "Tooth extraction" did not eliminate ASFV from sow farms; 2) ASFV DNA was detected in blood from sows showing no clinical signs; 3) POC tests showed poor diagnostic performance. Limit POC PCR use on clinically ill animals.

ASF Research Projects in Vietnam Examining the Use of Serum and Oral Fluid ELISAs

Two separate research projects on ELISAs being conducted in Vietnam continued and provided a final and a preliminary report. The first project is being done by Biostone Animal Health, in collaboration with the Canadian Food Inspection Agency's (CFIA's) National Centre for Foreign Animal Disease (NCFAD). Goals of the study are to generate a panel of 2000 pig serum samples with known ASF infection status, determine the diagnostic sensitivity and specificity of the ELISAs in the study using the panel, and, finally, to perform an inter-laboratory evaluation of the assays in the United States and Canada. COVID-19-related issues have delayed completion.

Another ELISA-based study evaluated the performance of ASF serum and/or oral fluid ELISAs for use in the surveillance and monitoring of ASF outbreaks on commercial farms in Vietnam and in preparation for the virus becoming endemic in the United States. This study shows there is no single best diagnostic approach for ASFV surveillance and demonstrates that the combined use of the Tetracore qPCR and indirect ELISA tests and serum/oral fluid sampling increase efficiency of ASF disease surveillance.

Determining the Pathways for ASF Introduction into Boar Studs and Risk of ASF Transmission via Semen Movements During an ASF Outbreak

The overall objective was to determine the risk of introducing ASF to a sow farm as a result of semen movement from apparently healthy boar studs in an ASF disease control area. A proactive risk assessment (RA) was performed that looked at the potential risk of semen movements during an outbreak.

An ASF Boar Semen RA workgroup (WG) was established; the group's members included 19 boar stud subject matter experts (SMEs), six pork producer representatives, 12 federal/state agency veterinarians, and 16 academics. The WG was asked to help answer these questions:

1. What are the pathways of ASF introduction into boar studs?

The 10 potential entry pathways are people, feed, water, geographic and/or aerosol transmission, fomites (such as tools, equipment, vehicles), mortality management, domestic animals (such as dogs, cats, replacement boars), biological materials (such as medicines and vaccines), insects/ticks, and wildlife.

2. How likely are these 10 pathways to lead to ASF infection of a boar stud in a disease control area?

As a result of WG meetings and studying the findings from published scientific reports and data from outbreaks in Vietnam, each of the pathways was evaluated and assigned a likelihood rank that ranges from negligible to high.

- The likelihood of water being a pathway to ASFV infection of a boar stud in a control area was negligible, as long as no surface water is used in the boar stud operation.
- The likelihood of feed, insects/arthropods, and wildlife (including infected feral pigs) being pathways to ASFV infection was negligible to low, as long as farms continue their standard biosecurity practices, such as providing boars with tandem feed bins, practicing insect control, providing indoor housing, and providing double fencing.
- The likelihood of people, fomites, domestic animals (including replacement boars), and biological materials to be pathways to ASFV infection was low, as long as farms follow

requirements and procedures such as shower-in/shower-out people entry, with downtime from other pigs; decontamination and disinfection of materials entering the stud; and housing of replacement boars in isolation barns away from the boar stud and lab.

This proactive RA is an evolving, product-specific risk assessment that will be reviewed before distribution to the swine industry, state animal health officials, and the U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA APHIS). It will be reviewed and updated as necessary before and during an ASF outbreak to incorporate the latest scientific information and preventive measures. If the Incident Command System (ICS) is activated in response to an ASF outbreak, Incident Command staff will have this RA to evaluate industry requests for movement of liquid, cooled boar semen from a boar stud in a control area.

Time and Temperature Required for Complete Inactivation of ASFV

The objective of this project was to determine the optimal baking time and temperature required to completely inactivate ASFV in aluminum-surface-contaminated swine feces. Specifically, this project tested the effectiveness of the use of thermal-assisted drying and decontamination (TADD), which commonly operates at the temperature between 63°C and 71°C. Three cleaning protocols were used: baking contaminated trays without additional cleaning, power washing the tray surface with water at room temperature prior to baking, and power washing the tray surface with water, followed by applying a disinfectant prior to baking.

The highly virulent ASFV strain currently circulating in Vietnam was inactivated at 54°C within five minutes. However, heat treatment did not eliminate the viral genomic DNA, as the swabs were still PCR positive. One major limitation of this study is that virus isolation was used as the means to evaluate virus inactivation. Subsequently, an amendment using bioassay was conducted.

With support from the SHIC (grant no. 20-071), swabs collected from contaminated trays at all time-points post-incubation 54°C and 63°C were found to be PCR positive, indicating that heat treatment could not eliminate viral genomic DNA. On the other hand, swabs collected from contaminated trays at five minutes post-incubation at either 54°C or 63°C were negative by virus isolation assay, indicating that holding ASFV in the presence of feces at 54°C for five minutes was sufficient to inactivate the virus, according to virus isolation.

One major limitation of the previous study was that virus isolation was used as the means to evaluate virus inactivation. The virus isolation assay might not be sensitive enough to detect the virus in samples that have low levels of infectious virus.

The primary objective of the amendment was to conduct a pig bioassay to verify if holding ASFV-contaminated feces at 54°C for 10 minutes would completely inactivate the virus. Consistent with the previous results, holding ASFV-contaminated feces at 54°C for 10 minutes resulted in negative virus isolation. However, all four pigs inoculated with the content collected from trays after a 10-minute incubation at 54°C became infected with the virus, with viral genomic DNA detected in their blood at five days post-inoculation. Therefore, incubation of ASFV-contaminated feces at 54°C for 10 minutes was not effective at completely inactivating the virus.

Evaluating the Diagnostic Performance of Pen-Side Tests for ASF Detection

Objectives of this project are to determine the time from infection to the earliest detection of the pen-side tests and to determine the sensitivity and specificity of the pen-side tests for detection of ASF in the field. In this study, performance of three pen-side tests for ASFV detection, one PCR test for detection of viral genomic DNA and two lateral flow tests for detection of viral antigens, were evaluated.

The first objective was to determine the time from infection to the earliest detection. Ten pigs were experimentally infected with an ASFV strain. Whole blood and oral swab samples were alternatively collected from five pigs every other day post-infection and tested with the three pen-side tests. The antigen test did not work well when tested with oral swabs. Compared with the reference laboratory real-time PCR test, the pen-side PCR test exhibited 97.8% sensitivity and 100% specificity. The antigen had 100% specificity but only 47.8% sensitivity, mainly because it failed to detect infection from samples collected early or late after infection.

The second objective was to evaluate the diagnostic performance of the tests with samples collected from the field. In whole blood and oral swabs collected from 205 pigs, there were 34 positives and 171 negatives as determined by the reference laboratory real-time PCR. All pen-side tests had 100% specificity, regardless of the sample types tested. The sensitivity of the pen-side PCR test was 88.2% and 70.4%, respectively, when tested with whole blood and oral swab. The sensitivity of the antigen test was 50% and 11.11%, respectively, when tested with whole blood and oral swabs.

The results of this study show that the PCR pen-side test has better performance than the antigen test, as it can detect infected pigs earlier and for a longer duration after infection than the antigen test. In addition, the pen-side PCR test works with whole blood and oral swabs, while the antigen test works only with whole blood.

Field Projects Still to be Completed

Field Evaluation of Oral Fluids as a Convenient, Aggregate Sample for Early Detection of ASF

The objective of this project is to conduct a field evaluation of oral fluids in Vietnam for early detection of ASFV. The project timeline was significantly shifted due to COVID-19-related travel restrictions. It was also difficult to find farms that had both early-stage ASF infections and farmers willing to be compensated for the use of their pigs in the project.

Collection of oral fluids and other sample types from 100 pigs belonging to one ASF-infected farm was successfully conducted between December 14, 2021, and January 8, 2022. An ASFV infected farm with a total of 500 pigs was identified and 100 healthy looking pigs from there were separated and housed in a different clean location. Between December 14, 2021, and January 8, 2022, the non-clinical pigs were kept in four pens: A, B, C, and D. Oral fluids were continuously collected from pigs all four pens daily and stored at -70°C immediately. Whole blood and swabs were collected every other day.

After seven days, one pig in pen B came down with ASF. The disease spread within the pen in a week as pigs started showing clinical signs, such as fever and lethargy; some were also found dead. The blood

and tissue samples tested from the dead pigs in the affected pen B tested positive for ASFV genomic material.

It took at least 14 days following the first detection in pen B for ASF to be detected in the adjacent pens A, C and D, through testing of blood, serum, or spleens in dead pigs. Samples from at least two clinically sick pigs were tested by the collaborators at various times using real-time PCR tests to confirm ASF infection. Sample collection and evaluation of the clinical disease continued for 28 days from the initial detection in one pig. During the sample collection period, a total of 58 pigs died.

A total of 113 oral fluid samples were collected among four pens. Because the testing team cannot travel to Vietnam for sample testing, the collected samples are being prepared for shipment to CIFA's NCFAD for testing. According to the original proposed plan, a minimum of 500 pigs from at least two ASF-infected farms were to be involved in testing oral fluids. Plans continue to include at least 500 pigs in the project.

Identifying Pathways of Entry of ASFV onto Farms to Enhance Information for Improving Biosecurity in Vietnam

Objectives of the project include the use of the Rapid Response investigation form used by the U.S. Rapid Response Teams to investigate ASF pathways onto the farms; to use the Rapid Response investigation form in an electronic format, which can compile the data and provide answers as soon as the data sheet is populated; and to make recommendations for how to mitigate the identified gaps in Vietnamese farm biosecurity and improve the situation on the respective farms.

Iowa State University and the Rapid Response Teams management center have agreed to collaborate. A non-disclosure agreement has been signed with swine farms in Vietnam that have agreed to participate in the collaborative project. A set of questions on biosecurity specific to ASF for the swine farms has been developed and is being used in the investigations. They are continuing to gather as much data as possible within the project. Water sources, feed trucks, replacement breeding animals, semen source and visitors have been identified as highest risk factors or events. The investigation form is being converted so that the data can be collected electronically on a website.

Swine Health Information Center Communications

Many communications tools are employed to disseminate information to stakeholders, including the SHIC website, e-newsletter, articles prepared for partners, news releases, interviews with Drs. Paul Sundberg and Megan Niederwerder, social media, SHIC Talk podcast, and webinar series. SHIC also participates in industry events to provide access to information essential to protection of US swine herd health. Google Analytics data of SHIC website traffic are used to measure impact of media efforts.

1. Activity on www.swinehealth.org

1) Top pages on SHIC website (January 1-November 20, 2022) with (number of visits):

- Homepage (13,289)
- Seneca Valley Virus Summary (3,574)
- Global Disease Monitoring Reports (3,036)

- Domestic Disease Monitoring Reports (2,518)
- Disease Monitoring Reports (1,774)
- About (1,512)
- Podcasts (1,382)
- Call for Research (1,271)
- African Swine Fever (1,126)
- Latest News (1,054)

2) Continuous WordPress and plugin updates completed

3) Website content updated with relevant content

- Added Wean-to-Harvest Biosecurity Program page
- Posted press releases and articles
- Posted monthly newsletters
- Posted research results

2. Website impact (January 1-November 20, 2022; For comparison, 2021 results are included in parentheses after each applicable line)

- Over 30,276 individual sessions (14,775)
- 20,666 separate users (11,952)
- 58,199 total page views (25,663)
- Average of 1.92 pages per session (1.41)
- Average session duration of 1:22 (1:23)
- Top 10 countries
  - 11,095 users were from the USA (5,682)
  - 1,641 users were from Germany (611)
  - 1,043 users were from the United Kingdom (375)
  - 804 users were from Canada (456)
  - 520 users were from India (153)
  - 431 users were from the Philippines (284)
  - 342 users were from Japan (83)
  - 305 users were from Mexico (132)
  - 264 users were from Australia (117)
  - 257 users were from China (194)

3. Press releases

Six SHIC-specific press releases were issued in 2022:

- New Research Project to Investigate Feed Mill Decontamination in the Event of an ASF Outbreak
- SHIC Announces New Associate Director Megan Niederwerder
- SHIC Sets Focus on Wean-to-Harvest Biosecurity
- Bang and Ruen Join SHIC Board of Directors
- New Research Defines ASFV Stability in Feed Held at Three Storage Temperatures

- SHIC Wean-to-Harvest Biosecurity Program RFPs Released

Key media remain engaged by direct contact plus receive the SHIC e-newsletter and monitor social media posts. Several articles from the e-newsletter drove interviews and prompted follow-up by media.

4. Press release impact

Emails were sent to 250 ag news outlets for each press release. Farm broadcasters continued as a very important media outreach for SHIC with follow-up interviews requested after each press release was deployed.

Individual emails are sent to the top five pork media editors as well as five 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. So far this year, more than 80 interviews with Drs. Sundberg and Niederwerder have taken place. Publications, radio networks, and stations receiving personalized emails include:

- National Hog Farmer/Farm Progress Publications - 3 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
- Market Talk Ag – National
- Red River Farm Network
- Agriculture of America – National
- Ag Daily News Podcast

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.

5. Event Interview Opportunities

Multiple media interviews were given throughout the year. Participation in the National Association of Farm Broadcasters annual meeting and Trade Talk, American Association of Swine Veterinarians (AASV) Annual Meeting as well as other industry events always have good results.

6. Articles Prepared for Partners

As of November 20, 2022, content was provided for 48 articles for the AASV weekly e-letter and other partners, including:

- Post-symposium, SHIC Continues Work on JEV Preparedness and Next Steps
- SHIC-Funded Project Looking at Vehicle Networks and Disease Dissemination
- SHIC Rapid Response Teams Stand Ready
- SHIC Notes CSF and ASF Ruled Out in Ecuador
- JEV Symposium: Potential Animal Hosts of JEV in North America
- JEV Symposium: US Preparedness Underway
- JEV Symposium: Australian Experience Informs US Preparedness
- SHIC Wean-to-Harvest Biosecurity Program RFPs Released
- Survey Highlights Value of SHIC Disease Monitoring Reports to Swine Industry
- SHIC/AASV Webinar Addresses Undiagnosed Respiratory Disease Pursuit and Sampling
- SHIC Monitoring Newly Identified Swine Disease in Ecuador
- SHIC Sets Focus on Wean-to-Harvest Biosecurity
- SHIC's Domestic Swine Disease Monitoring Report Renewed for 2023
- SHIC Looks at Bacterial Spillover Between Species for Potential to Cause Emerging Disease
- SHIC - ASF Vaccine Status in Vietnam Update
- SHIC Sponsoring 2022 NAPRRS Symposium Sessions
- SHIC-Funded Project Pursues Disease Warning Tool
- SHIC Sponsoring JEV Symposium - Australian Lessons Learned and US Prevention and Planning
- Register Now: October 4 SHIC/AASV Webinar on Undiagnosed Respiratory Disease
- SHIC-funded Study Looks at Time by Temp Effectiveness in Supply Entry Rooms
- SHIC Talk Podcast Offers ASF Update with AASV, NPB, NPPC
- Pen-side ASFV Testing Evaluated in SHIC-Funded Study in Vietnam
- SHIC-Funded SDRS Investigates Influenza A Virus Spillover
- SHIC Board of Directors Welcomes New Members and Elects Officers
- SHIC-Supported PCV3 Clinical Sign and Pathology Investigation Informs Case Definition Work
- SHIC Board of Directors Sets New Focus on Finishing Phase Biosecurity
- SHIC-Funded Morbillivirus Investigation Confirms No US Detection
- SHIC-funded Project Examines Growing Pig Site Biosecurity Gaps
- SHIC-Funded Study Looks to Other Industries for Infectious Aerosol Biocontainment Ideas
- SHIC investigates canine parvovirus 2 for potential risk to US swine
- SHIC-Funded Characterization of S. zooepidemicus Isolates from Indiana Complete
- SHIC Initiated Swine Disease Reporting System Continues to Expand with PCV2
- SHIC Work on Feed as a Vector for Transboundary/Emerging Disease Transmission
- SHIC Updates PCV3 Fact Sheet and Pursues Case Definition
- SHIC/AASV Webinar Examines JEV Outbreak in Australia and Risk for US Herds

- SHIC Initiated Swine Disease Reporting System Expands to Include IAV
- SHIC/AASV Webinar on Australian Outbreak of JEV on March 29
- SHIC Reports on an Australian Outbreak of Japanese Encephalitis Virus in Pigs
- SHIC APP15 Outbreak Investigation – Preliminary Lab Report
- SHIC Announces New Associate Director Megan Niederwerder
- SHIC-Funded Research Questions Feed Role in PDCoV Outbreaks
- SHIC Funded MSHMP Reports on 2022 Results and Progress
- SHIC Explores Expansion of Domestic Swine Disease Reporting System
- SHIC 2022 Plan of Work Targets Disease Monitoring, Transport Biosecurity, More
- SHIC/AASV Webinar Addresses APP Outbreak, Management Strategies
- SHIC-Funded Study on Feed Goes Beyond Mathematical Half-life Calculations
- SHIC's 2021 Progress Report Details the Year's Highlights and Successes
- SHIC Update on ASF Found in Italy; Macedonia and Thailand Report Cases

Organizations like the US Animal Health Association (USAHA) are using SHIC information gleaned from media and the e-newsletter to share with their audiences. With USAHA, this means distribution to state animal health officials as well as key federal animal health officials.

7. SHIC e-newsletters

In 2022, the monthly SHIC e-newsletter publication schedule continued. The distribution list has grown to over 3,000 subscribers and is consistently updated. The following chart details SHIC e-newsletter acceptance and impact.

SHIC Enewsletter Stats

Edition	Number	Date Sent	# Sent	Opens	Opens %	Unsubs	Clicks	Click %
January 2022 newsletter	107-59	1/4/2022	3087	1012	35.2%	2	243	5.5%
ASF in Italy		1/7/2022	3089	935	32.5%	0	85	1.7%
February 2022 newsletter	107-60	2/4/2022	3102	958	33.3%	2	250	5.8%
March 2022 newsletter	107-61	3/4/2022	3135	1015	35.0%	2	154	4.0%
JEV webinar send 1	111	3/23/2022	3132	900	31.1%	1	140	3.9%
JEV webinar send 2	111	3/28/2022	3131	901	31.2%	3	106	2.9%
April 2022 newsletter	107-62	4/6/2022	3141	1009	35.0%	3	220	6.1%
May 2022 newsletter	107-63	5/4/2022	3150	790	27.1%	3	151	3.5%
June 2022 newsletter	107-64	6/6/2022	3153	1010	35.0%	2	195	5.0%
UK FAD Response		6/24/2022	3147	1230	42.9%	0	122	2.9%
July 2022 newsletter	107-65	7/5/2022	3157	1036	36.0%	0	203	5.7%
August 2022 newsletter	107-66	8/3/2022	3150	1057	36.9%	3	186	5.5%
September 2022 newsletter	107-67	9/7/2022	3165	990	34.6%	1	200	5.4%
October 2022 newsletter	107-68	10/5/2022	3163	980	34.2%	2	249	6.6%
November 2022 newsletter	107-69	11/2/2022	3181	1019	35.6%	5	165	4.7%
Averages				**989.47**	**34.37%**		**178**	**4.61%**
Benchmarks**					33.4%			1.46%

* Clicks = following a link from the newsletter to the SHIC website.

** Benchmarks are industry standard averages per Constant Contact, the email distribution platform used for the newsletter.

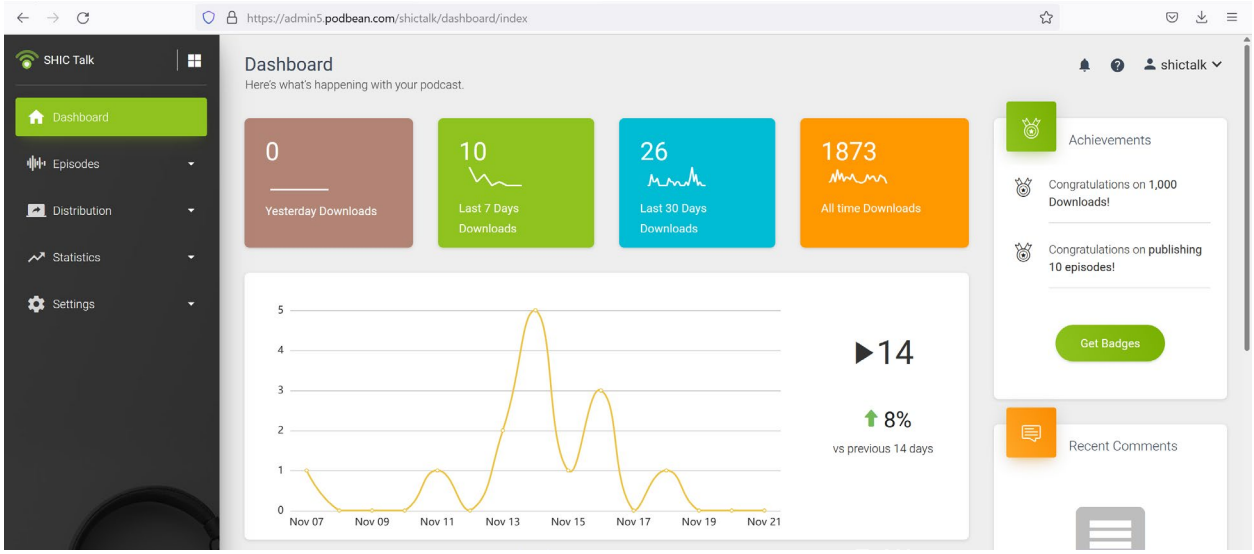
8. SHIC Talk Podcast

In 2022, SHIC Talk episodes continued to be produced. The podcast is hosted by Barb Determan and features guests on "industry chatter" topics. Five episodes have been produced in 2022. SHIC Talk is available on the SHIC website as well as Apple Podcasts, Google Podcasts, Spotify, Amazon Music/Audible, TuneIn/Alexa, and iHeart Radio.

2022 Episodes

- SHIC Wean-to-Harvest Biosecurity Program with Drs. Paul Sundberg and Megan Niederwerder – September 2022
- African Swine Fever Update with Drs. Megan Niederwerder, Harry Snelson, Liz Wagstrom, and Patrick Webb – July 2022
- FAD Prevention and Feed Research with Drs. Sundberg and Niederwerder – May 2022
- JEV Outbreak in Australia with Drs. Natalia Cernicchiaro and Lee Cohnstaedt – April 2022
- Biosecurity with Dr. Clayton Johnson – January 2022

Podcast Listenership



9. Webinars

SHIC offered a series of webinars with co-sponsor the American Association of Swine Veterinarians in 2022. The quarterly webinars respond to "industry chatter" about current swine health issues. The webinars are conducted by Iowa State University Swine Medicine Education Center staff. Webinars as of November 20, 2022:

- Undiagnosed Respiratory Disease – October 2022
  - Presenters: Dr. Evan Koep, Pipestone, Dr. Ben Hause, VP of Research and Development and Diagnostics at Cambridge Technologies, Dr. Rachel Derscheid, diagnostic pathologist

at the Iowa State University Veterinary Diagnostic Lab, and Dr. Michael Rahe, diagnostic pathologist at the Iowa State University Veterinary Diagnostic Lab

- Australia's JEV Outbreak – March 2022
    - Presenters: Drs. Bernie Gleeson and Kirsty Richards, SunPork of Australia, Dr. Leela Noronha, Research Veterinary Medical Officer, Foreign Arthropod-Borne Animal Diseases Research Unit, National Bio and Agro-Defense Facility, Dr. Natalia Cernicchiaro, Kansas State University, Associate Professor, Epidemiology
- APP Incidence and Management – February 2022
    - Presenters: Dr. Marcelo Almeida, Iowa State University, Dr. Alyona Michael, Iowa State University, Dr. Pete Thomas, Iowa Select Farms, and Dr. Ian Levis, Seaboard Foods

Webinars will continue with subject matter and presenters to be determined.