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

SHIC Seeks Input for 2024 Plan of Work

The Swine Health Information Center is currently requesting input for its 2024 Plan of Work from all stakeholders across the swine industry. Input may include topic areas, research priorities, and identified industry needs in which SHIC should focus efforts, such as an emerging swine disease or an emerging swine health issue. SHIC's Plan of Work helps guide activities for the coming year across five strategic areas, including improving swine health information, monitoring and mitigating risks to swine health, responding to emerging disease, surveillance and discovery of emerging disease, and swine disease matrices. Input across all five areas is welcomed and encouraged. Rather than restricting efforts of the Center, the annual Plan of Work provides a roadmap while remaining flexible, allowing SHIC to react to emerging issues of the swine industry as they occur in real-time. This aligns with SHIC's mission, which

is to protect and enhance the health of the US swine herd by minimizing the impact of emerging disease threats through preparedness, coordinated communications, global disease monitoring, analysis of swine health data, and targeted research investments.

Suggestions for the 2024 SHIC Plan of Work may be submitted online through the SHIC website or may be submitted directly to SHIC Associate Director Dr. Megan Niederwerder at mniederwerder@swinehealth.org or SHIC Executive Director Dr. Paul Sundberg at psundberg@swinehealth.org. Input and ideas are welcomed for the 2024 Plan of Work process through November 10, 2023. Additional input and ideas are welcomed anytime throughout the year to inform newly identified needs which may necessitate adapting or adjusting the Plan of Work. Being nimble and responsive to realities in the US swine industry reflects SHIC's mission and illustrates the Center's strengths. The 2023 Plan of Work can be found here.

SHIC Pursues Diagnostic Test Capable of Detecting Multiple Swine Viruses Simultaneously from Field Samples

Researchers Drs. Noelle Noyes, Montserrat Torremorell, and colleagues at the University of Minnesota developed a workflow called TELSVirus, or Target-Enriched Long-Read Sequencing of Virus, that enables the real-time detection and genomic characterization of multiple viral pathogens from a single sample in a relatively short turnaround time (approximately 24 hours). As part of a SHIC-funded study, the researchers' main objective was to apply the TELSVirus workflow to porcine oral fluid samples to detect and characterize genomes of target viral pathogens.

Overall, the diagnostic test developed through TELSVirus enabled researchers to detect a high prevalence of co-circulating yet understudied viruses, including porcine bocavirus, porcine sapelovirus 1, and porcine astrovirus 2 and 4, while also allowing for detection of viruses with known production impacts, such as PRRSV, influenza, and rotavirus. These viruses were often detected in the same oral fluid sample, and the high sequencing coverage afforded by TELSVirus allowed for robust viral variant analysis. Researchers also demonstrated that TELSVirus' limit of detection for PRRSV and influenza is comparable to that of qPCR, while providing the benefits of increased genomic information. Based on these results, TELSVirus has the potential to support real-time surveillance of endemic and emergent viruses, while also improving understanding of co-circulating viruses, their genetic diversity, and ultimately how they impact swine health and production.

Viral co-infections on swine farms are common and frequent, contributing to aggravated disease outcomes as well as impairing economic profit and animal well-being. In addition, due to high mutation rates, the co-circulation of viruses within swine herds facilitates the emergence and re-emergence of new variants, potentially impairing disease investigation, control, and prevention. Despite significant cost and health relevance, viral co-infections are understudied, in part due to limitations in sequencing techniques able to generate full-length sequences of multiple viruses from field samples. The detection and genomic characterization of novel variants are still a challenge, and many questions about the dynamics and interactions of co-circulating viruses in swine herds remain.

Drs. Noyes and Torremorell plan to pursue further funding for additional work and development of best practices for testing field samples using this process. They reported their first attempt to incorporate TELSVirus as part of a veterinary diagnostic workflow and showed promising results but is still a work in progress. Researchers are continuing discussions with the veterinary diagnostic laboratory to pursue further application of this testing platform.

SHIC Wean-to-Harvest Biosecurity: Investigating Manure Pumping Effects on Disease Interim Report

With funding from SHIC, the Foundation for Food & Agriculture Research, and Pork Checkoff, a team comprised of Dr. Daniel C. L. Linhares, Dr. Gustavo de Sousa e Silva, Dr. Ana Paula Poeta Silva, and Daniel Moraes with the Iowa State University College of Veterinary Medicine have begun a study examining manure pumping effects on disease onset in wean-to-finish pigs. Their objective is to identify practices related to manure pumping that can be managed to decrease incidence of disease onset in these pig populations. Their study will identify risk factors associated with disease onset in wean-to-finish sites following manure pumping and spread as well as detection of PRRSV and PEDV in pigs and environmental surfaces of wean-to-finish sites before and after manure pumping. The interim report reveals learnings to date.

A preliminary analysis using the participating wean-to-finish sites that pumped manure between August 2020 and December 2022 was done to describe the association between manure pumping practices and pig mortality in wean-to-finish sites. In this preliminary analysis, the outcome of interest was the cumulative mortality in the two weeks following the pumping event, divided by the total number of existing pigs on site until the pumping date (percentage). Other risk factors, including manure pumping-related practices, transport method (tank or drag hose), manure application method to the crop (direct injection or airway), and facility storage (deep pit or lagoon), was tested using mixed-effect binomial regression.

The preliminary analysis concluded a total of 3,000 pumping events occurred during the study period across 594 wean-to-finish sites and 1,358 pig lots. A median of two pumping events per pig lot was observed. The pig mortality rate in the two weeks following the first pumping event was 21.3% lower in sites that transported manure using tanks compared to sites using drag hoses. No statistical difference in mortality was observed between sites that applied manure to surrounding fields using either direct injection or airway. Likewise, no statistical difference was observed in mortality between sites that included manure storage in deep pits versus lagoons or concrete vats.

The preliminary data analysis found that using tanks to transport manure to crop fields that are farther away from the pumped site was associated with a lower mortality in the two weeks following the first pumping event when compared to drag hose. These results demonstrated an association between the distance at which manure was applied and disease onset and mortality rates after pumping events.

The next step for the ongoing study will be modeling that includes sites with and without disease onset, and with and without exposure to pumping. This will reveal the spatial-temporal relationships between the risk of disease onset and pumping manure into the site surroundings, or pumping manure out. Final results of this ongoing study will be posted when available.

SHIC, along with the Foundation for Food & Agriculture Research and Pork Checkoff, funded the Wean-to-Harvest Biosecurity Research Program to address an identified gap in US swine industry emerging disease preparedness and develop cost-effective innovative tools to enhance biosecurity during the wean-to-harvest phases of pork production.

SHIC Funds Regional Swine Disease Warning Tool Development and Testing

With funding provided by SHIC, the Morrison Swine Health Monitoring Project team at the University of Minnesota developed and tested a tool to enable timely communication of regional disease activity, The Early Regional Occurrence Warning project. TEROW represents additional infrastructure to respond to emerging diseases and highlights efforts towards preparedness, as it can be utilized for a wide range of diseases with the application of standardized monitoring through MSHMP.

Using porcine reproductive and respiratory syndrome in the beta testing, principal investigator Dr. Mariana Kukuti and her team developed a code to retrieve and summarize, for each enrolled site, the total number of sites within a 25(+)-mile radius experiencing an ongoing PRRS outbreak, as well

as a trend indicator to show if the number of cases increased or decreased from the previous week.

Researchers conducted several individual meetings with volunteer participants to accommodate possible concerns with confidentiality before rolling out TEROW reports. The final content and formatting of the report were developed with participant input by adding information that would facilitate report interpretation, thus becoming potentially more actionable.

Each participating system provided a list of approved email recipients to receive the weekly system-specific email. Researchers were able to fully automate reporting processes so participants receive weekly TEROW reports without any additional action steps on their part other than their regular participation in MSHMP.

Developed automation not only generates TEROW reports but also automatically adjusts the radius if confidentiality criteria is at risk, as well as automatically sends system-specific reports to avoid manual errors. This tool fosters communication between industry stakeholders and provides the opportunity to quickly respond to infectious disease threats by making changes to their operations to decrease likelihood of exposure and thus reducing regional transmission and lowering regional disease pressure.

MSHMP's primary mission, capturing and analyzing swine health data on a weekly basis from participating farms, makes TEROW possible. TEROW remains open for participation. Producers and practitioners who would like to better understand regional disease occurrence are encouraged to contact MSHMP by emailing Dr. Cesar Corzo at corzo@umn.edu to learn more about enrollment.

SHIC Helps Refine PCV3 Case Definition with VDL Study

Currently, diagnosis of porcine circovirus type 3 is based on quantifying viral DNA by PCR and occasional confirmation by *in situ* hybridization of lesions associated with PCV3 infection. However, PCV3 has been detected in clinically and subclinically infected animals, and data to help standardize the PCV3 case definition is needed. A SHIC-funded study conducted by principal investigator Dr. Pablo Pineyro, Iowa State University, provided valuable insights into the diagnosis and prevalence of PCV3 in reproductive failure and surveillance cases submitted to the ISU-VDL as well as the synergism of PCV3 with PRRSV and PCV2.

PCV 3 was initially described as affecting swine in 2016, and since its first description, PCV3 has been detected globally and retrospectively in pigs of all ages. It has been associated with a range of clinical presentations, including reproductive failure, porcine dermatitis and nephropathy syndrome, multisystemic inflammation, respiratory disease, enteric disease, and subclinical infection. However, for many of these clinical presentations, the causative role of PCV3 is not well understood.

The first objective of this study was to establish a Ct PCR value that correlates with the presence of lesions compatible with PCV3 infection. Researchers' retrospective investigation showed there is a correlation between Ct values and the presence of lesions, keeping in mind that lower Ct values represent higher levels of virus. Cases confirmed by histopathology with lesions consistent with multisystemic inflammation showed Ct values below 30. In addition, the presence of PCV3 in these cases was confirmed by in situ hybridization, adding diagnostic value to the combination of histopathology and PCR detection.

Another objective of this study was to evaluate commonly submitted sample types that could be used for subclinical PCV3 detection, such as oral fluids, processing fluids, and serum. Most of these samples were not linked to a specific clinical problem in their submission. Evaluation of the Ct value distribution of these samples demonstrates that a high proportion have Ct values above 32. These sample matrices could indicate viral shedding, vertical transmission on sow units, or viremia in grow-finish pigs. However, the clinical implication of positive results on these sample matrices cannot be extrapolated to assess the presence of PCV3-associated disease.

An additional evaluation of submissions from reproductive failure associated with PCV3 showed

that Ct values on cases confirmed only by PCR or a combination of PCR and histological evaluation do not differ. These results suggest that PCR on fetal tissue could be sufficient to confirm causation. However, a high proportion of cases showed co-infection with PRRSV and PCV2. The Ct values on these co-infection cases showed a positive correlation, suggesting that these viruses have a synergistic effect with a higher PCV3 viral load when these viruses are detected together.

Researchers concluded that the diagnosis of PCV3-associated disease should be based on a combination of diagnostic tools, including lesions of multisystemic inflammation, PCR Ct values lower than 30, and additional confirmation by direct detection methods. The samples used for surveillance and subclinical evaluation could be used as a proxy for viral circulation in a sow herd or in grower pigs but should not be implicated as causing multisystemic inflammation or reproductive failure. Further research is required to understand the interactions between PCV3 and other pathogens during co-infections and to establish the significance of viral loads in subclinical cases.

SWINE DISEASE MONITORING REPORTS

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

DOMESTIC

This month's Domestic Swine Disease Monitoring Report brings information about the increased positivity in the wean-to-market category of PRRSV, IAV, and on the adult/sow farm for PCV2 and MHP. Even though the increased positivity was expected for September, this finding raises an alert for increased activity in various endemic pathogens during September. At a regional level, PRRSV had increased positivity in Illinois and Ohio; PEDV in Missouri and North Carolina; and PDCoV in Kansas. For *Mycoplasma hyopneumoniae*, most of the positive submissions came from tissue samples. Also, ISU-VDL tissue diagnosis brings *Mycoplasma hyopneumoniae* across the 10 most confirmed tissue diagnoses. On the SDRS podcast, Dr. Gustavo Silva, an Assistant Professor at Iowa State, discusses the importance of disease diagnostics for production management and the cost of *M. hyopneumoniae* elimination.

VIEW REPORT

GLOBAL

In this month's Global Swine Disease Monitoring Report, learn about the first report of African swine fever in Sweden where 41 cases were confirmed in wild boar. In the Lombardy region of Italy, over 30,000 animals have been culled and the presence of ASFV Genotype 2 has been confirmed in Sardinia. In Hungary, researchers are planning to conduct a field trial involving bait infused with an experimental ASFV vaccine in forests of the nation. The first outbreak of Nipah virus since 2021 was reported in Kerala state. In the US at the Louisville Port of Entry, US Customs and Border Protection agents intercepted 1,500 pounds of unauthorized pork and poultry shipments from Hong Kong.

VIEW REPORT