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When considering how to best prevent disease spread on-farm, what's good for the goose is good for the gander (and the pigs): Control at the Source.

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Reviewing surveillance reports detailing disease outbreaks can be nerve-wracking. If you have young children, ageing parents, or have a weakened immune system, the 'cold and flu season' can be potentially devastating. As such, and in an attempt to inform the public and implement activity aimed at preventing further spread of disease, the US Centers for Disease Control and Prevention (CDC) routinely publishes reports indicating current viral activity, including geographic spread (Figure 1.), trends and characteristics of seasonal outbreaks (e.g. numbers of individuals with reported disease, number of hospitalizations, number of deaths, etc.) (Figure 2.).

The end of 2019 also brought with it the emergence of a novel (new) strain of Coronavirus (COVID-19), with the first

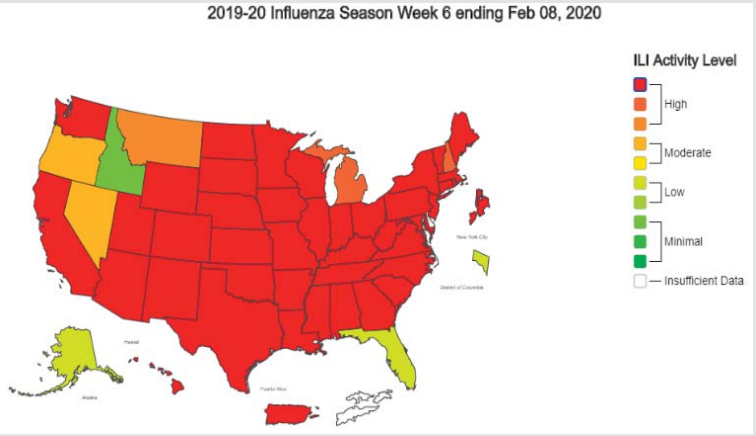

Figure 1. CDC Surveillance depicting influenza like illness (ILI) activity in week 6 of the 2019-2020 flu season. Source: https://www.cdc.gov/flu/weekly/index.htm

reports of person-to-person spread in the United States occurring on January 30, 2020. Almost immediately, the US Health and Human Services Secretary, Alex Azar II , declared a Public Health Emergency (PHE) on January 31st, 2020 to allow for the immediate mobilization and response of the US healthcare system to rapidly identify and treat those affected and to minimize further spread (https://www.cdc.gov/coronavirus/2019-nCoV/summary.html).

With the identification of (novel) pathogenic organisms (e.g. viruses and bacteria), risk assessments are quickly performed to determine the source ('ground zero') and characteristics allowing for spread of disease (e.g. mode of transmission, requirements for replication), including whether there is a potential for disease to be transmitted between humans and animals (zoonoses). Bailey et. al. (2018) recently published a paper highlighting the threat for viral spread with a focus on the 'human-animal interface' and four respiratory viruses (Figure 3.)[2]. What becomes readily obvious is the influence of host species interaction in the prediction of emerging disease potentially resulting in an epidemic (actively spreading disease) or even pandemic (geographic spread, affecting an entire country or the world). Bailey et. al. (2018) highlight the need for continued and perhaps more intensive cross-functional and cross-species surveillance activity in order to more rapidly identify and effectively contain and prevent spread of disease.

Figure 2. CDC Surveillance estimating influenza incidence during the 2019-2020 flu season.
Source: https://www.cdc.gov/flu/index.htm

The prevention of transmission of seasonal influenza in humans routinely includes vaccination, the recommendation that sick individuals stay home (isolation) and the encouragement of cough etiquette and hand hygiene. Work in a healthcare setting or caring for a sick individual may warrant the implementation of 'droplet precautions' (the use of appropriately fitting and filtering respirators (masks)). Current efforts to prevent/minimize the spread of COVID-19 include the identification, isolation and treatment of known affected individuals, identification and isolation (quarantine) of those potentially exposed and limiting/restricting movement of humans and goods by air, boat or rail to minimize spread to other countries.

Obvious parallels can be drawn between humans and food animals with respects to the identification and control of seasonal and emerging disease. In a recent publication, Beltran-Alcrudo et. al. (2019) review transboundary swine diseases (TSDs) of major concern including African Swine Fever (ASF), Classical Swine Fever (CSF), Porcine Reproductive and Respiratory Syndrome Virus (PRRSv), Foot and Mouth Disease (FMD), and the recent increase in incidence (new cases) of Porcine Epidemic Diarrhea Virus (PEDv)[1]. The incidence and prevalence (existing cases) of disease is 'dynamic' in both time and space, with disease waning and then reemerging. Seasonal shifts in disease incidence and prevalence domestically may be found here: https://www.swinehealth.org/domestic-disease-surveillance-reports/. Surveillance data undercounts new cases of disease because cases from herds, which have become free of disease and then become re-infected (e.g. with PEDv or Porcine Delta Coronavirus (PDCOv)), are not included in the counts. Similar reports have indicated that PRRSv re-infection of wild type strains into pig herds are both devastating and persistent despite eradication programs. This has resulted in a persistent (endemic) status in North America[4].

In anticipation of ASF, teams comprised of staffs from regulatory agencies, veterinarians and producers have collaborated to develop phased protocols to address any future outbreak. As with COVID-19, plans are in place to limit or altogether halt transportation (enforced quarantine) should ASF be identified in North America, effectively limiting disease spread. Programs are in place to identify and destroy sources of pathogen in commercial goods (e.g. feedstuffs). Depopulation plans specify handling of mass mortality and adequate disinfection including sufficient latency for reintroduction of naïve animals to reduce the likelihood of infection of the new herd.

It is well known that the most efficient and successful means to control exposures to virus, or bacterium and risk of disease, irrespective of whether the focus is human or animal, is to enact control at the 'source', or in other words, actively work to prevent pathogen transport by the

host organism. This requires quarantine and isolation, targeted and appropriate hygiene practices and 'droplet precautions' to control spread of both emerging (COVID-19) and seasonal (Influenza) disease in humans. Implementation of appropriately modified practices are also effective in the control of pathogens affecting food animals. Unfortunately, routine management practices performed at livestock facilities – even when in compliance with established biosecurity protocols - have the potential to disperse (transport) pathogens to naive pigs on-site or at distant facilities or re-infect existing herds (e.g. PEDv and PRRSv)[5].

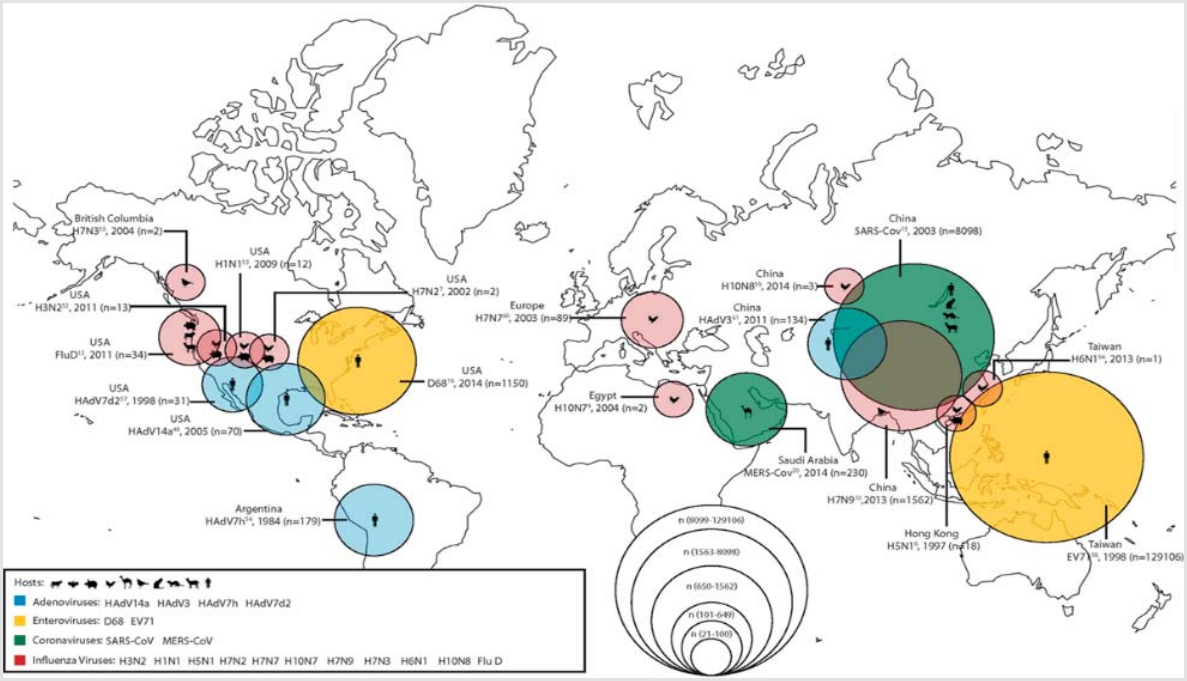

Figure 3. Location of first detection, reservoir (source of infectious agent), and number of cases during first outbreak (represented by size of circles) for four groups of viruses (Adenovirus, Enterovirus, Coronavirus and Influenza). From: Bailey et. al. (2018) (https://www.frontiersin.org/articles/10.3389/fpubh.2018.00104/full)

When developing your biosecurity plan, including Perimeter Buffer Zone (PBA) and Line of Separation (LOS), consider and identify all activities and 'touch points' where a host (human or animal), fomite (inanimate object or material that can carry pathogen) or process (activity) has the potential to physically transport or disperse (e.g. in mists/droplets or dusts) pathogen. This risk assessment should also include the behavior (approach) by which tasks are completed. Items to consider should include, but not be limited to, the following:

1. Use of 'common' tools (e.g. hoses, pitchforks, sorting boards, wheelbarrows, various cleaning implements (e.g. brooms) and equipment (e.g. tractors)) that have the potential to be in contact with sick animals or animal fluids and/or excrement and healthy animals/ clean areas.

2. Air movement within the facility (forced ventilation vs natural ventilation, use and placement of fans). Is there a potential for respiratory secretions or contaminated dusts to become airborne and move from isolation areas to pens with healthy pigs?

3. On-farm vehicle and pedestrian traffic. Is it possible for vehicles (cars, tractors, gators) and foot traffic – activity not already included in biosecurity protocols – to contact potentially contaminated sources (e.g. puddles, dirt/dusts) and track them into housing areas containing naïve pigs?

4. Manure handling and pumpdown. At any point, is it possible for aerosols from contaminated slurry in pits to become aerosolized and dispersed into barns? Is there sufficient distance between the slurry in pits and floor of the pens? Are pigs able to inhale contaminated aerosols (or even foam) when fans in pits are turned on? Are aerosols generated during pumpdown? If yes, do they have the potential to disperse and be transported via air movement back into the barns (re-infecting herds)? Is there splashing and puddling on roadways such that vehicle or pedestrian traffic has the potential to transport pathogen to distant areas on the property?

5. Mortality management. Are implements used to move animals sufficiently disinfected (including tractors) prior to coming in contact with 'clean' material? If composting, when forming or turning piles, is care taken to minimize airborne dispersion of potentially

contaminated material that has not yet reached temperatures sufficient to inactivate pathogen?

6. Zoonotic transfer. Are there provisions in place to prevent sick employees from coming in contact with pigs (e.g. administrative controls in the case of influenza or other viruses)? Is personal protective equipment (PPE) readily available to protect employees from coming into contact with sick pigs? Has training been performed such that employees effectively don and doff PPE in such a way so as to minimize the potential for contamination of their regular clothing?

Results of a risk assessment will allow for the development of cost effective and often readily implementable strategies (procedures) to control movement of pathogen. Examples of methods used to control dispersion are generally site/process specific, but may include interventions such as the use of 'wet methods' to minimize dispersion of dusts containing pathogen or slowing down the fill-rate when pumping out manure pits or lagoons to minimize aerosolization, splashing and puddling in roadways. The regular use of disinfectants on tools/farm implements and assuring sufficient contact time to kill pathogen is another easy-to-implement means to control pathogen spread.

Implementing 'source controls' allow for the potential to not only mitigate endemic disease within herds, but also protect against the transmission of seasonal and emerging disease. For assistance in conducting a site/process-based risk assessment or identifying appropriate source control strategies, please contact your MSU Extension team:

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Simple Ventilation Tips as Warm Weather Approaches

Ken Lamm, Provimi Ventilation Specialist and Casey Zangaro, MSU Swine Extension Educator

As winter starts to wind down, the temperature and humidity begins to increase inside livestock barns. Swine producers, in particular, need to be vigilant in the monitoring of their barn ventilation rates and air quality as the outside environment changes. There are several things to consider in order for ventilation to operate correctly inside swine production barns, such as fan stages and speeds, inlet air circulation, eaves openings, and overall controller settings.

Pit Fans

Swine barns today have up to seven stages that target an uptick in airflow using new fan(s) at various times. However, in the winter season, wall fans are typically not in use. Minimum ventilation is the predominant stage used in the winter months due to the cold and humid extremes. Typically, pit fans are used for minimum ventilation and have been working all winter as the prime ventilation source. These fans will be dirty

and will need to be cleaned in the spring, to keep the airflow happening efficiently throughout the barn. If fans are extremely dirty, this has the potential to reduce fan capacity by as much as 50 percent. If fans do not move enough air, they will go to the next stage of ventilation; this will decrease the overall ventilation efficiency within the barn and cause more power and electricity to be used to get the correct airflow and achieve the same CFM for the barn.

Eave Openings

Another winter ventilation concern is having fabricated coverings over the barn eaves to slow some of the cold air and precipitation. However, after a long winter, eaves can become blocked with heavy snow, rain, and ice; which renders them ineffective. If the eaves are not cleaned, dirt that has accumulated will block air from coming into the barn when more ventilation is needed as temperatures warm up and more air is required from eave openings. Be sure the screen in the eave opening is clean and free of obstruction for airflow purposes. Screens can be easily cleaned with a broom.

Humidity

Many producers and managers are under the misconception that heat or temperature is the reasoning for why barn ventilation is used. Humidity is an equally or sometimes more important reason for having air flow and movement through a barn. Humidity extremes can cause problems in swine barns. We ventilate to remove moisture from the barn. Humidity should be checked daily; preferably in various places throughout the barn. Humidistats can easily be obtained from a hardware store or farm supply store.

It is vital to adjust the ventilation system so that relative humidity within the barn is between 60 percent and 70 percent. This range has been shown to be the best for fighting respiratory infections. When the humidity is above 70 percent, airborne disease organisms multiply and spread easily, increasing the severity of respiratory infection. The dusty conditions, which can be caused by humidity below 60 percent, will worsen the effects of respiratory disease. Dust worsens effect of ammonia gas, airborne disease organism levels increase, and respiratory infection rate increases. Adjust ventilation for humidity to stays within the 60 percent - 70 percent range for the best air quality for pigs.

Air Speed

The recommended air inlet speed in a swine barn should be 600-900 ft./min. If the air entering the room from the ceiling inlets is moving too slow, then the air will not circulate properly and will fall directly down on the pigs creating excessive drafts and disrupt the manure patterns of pigs within the pens, which could increase the spread of disease. However, if the air enters the room too fast, this will result in erratic air circulation and temperature ultimately causing inconsistent drafts throughout the barn.

Air speed requirements vary by pig size and age. If pigs are less than 40 pounds, air speed should not exceed 30 ft./min. When pigs weigh from 40-240 pounds, air speed should not surpass 300 ft./min. Finally, when pigs weigh over 240 pounds; air speed should not go over 350 ft./min. A simple way to find the air speed throughout a barn is investing in an air speed meter. This device measures the air speed from inlets and at the pig level. This will help get the ventilation correct in warm months, as well as during irregular weather.

Controller Settings

Finally, looking at your controller settings is essential for every season change. For example, in winter, the ventilation should be set at 12 degrees from set point to last stage of ventilation. Conversely, in the warm weather months, the ventilation controller needs to be changed to 7 degrees from set point to last stage. If changes are not made barn will not cool properly in warm weather causing lower average daily gains. In addition, fan bandwidths on controller should be one degree between stages in summer months for pigs over 50 pounds. If your swine barn uses circulation fans, the placement of the fans and where they are pointed is critical as well. Circulation fans should be set to blow strait or slightly up. These fans should be blowing above pigs and not on them.

In conclusion, having an effective ventilation management program during transition seasons is essential for pig health and comfort, and minimizing cost. Ventilation is important for maximizing pig performance. These are just a few tips and reminders on what to look at in your barn for your ventilation system.

All comments and suggestions should be directed to the:

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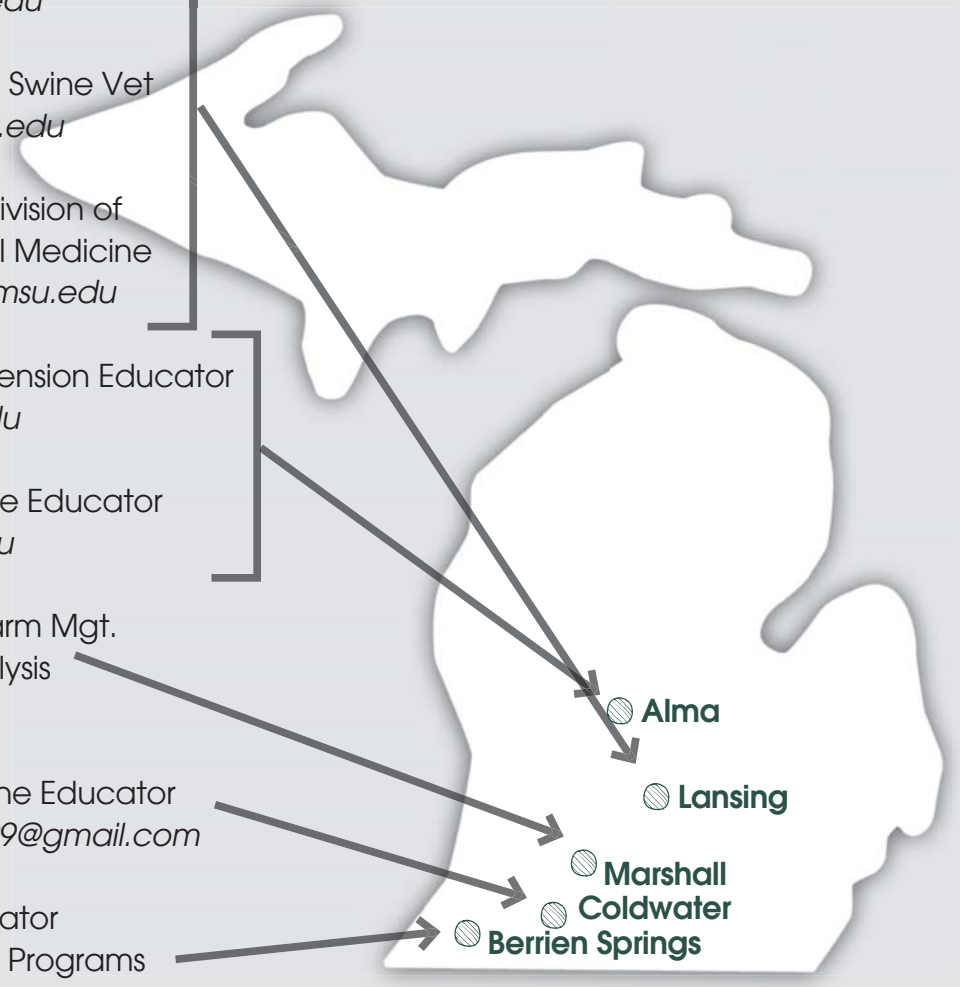

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