

Featured Speaker

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Commentaries

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Sarah

Hello, this is Dr. Sarah Probst Miller with Carthage Veterinary Service. Welcome to our second addition of P's in a Pod. P's in a Pod covers practical tips on pigs, production and profitability. P's in a Pod is a monthly podcast brought to you by Fort Dodge Animal Health and Carthage Veterinary Service.

Jim Lowe at our clinic has been doing SIV research with St. Jude's and the University of Minnesota monitoring SIV in swine herds. When we were first brainstorming topics for the podcasts at the beginning of the year, Jim immediately suggested SIV zoonosis as something we should cover. Little did we know how relevant it would be in light of the novel H1N1 flu break in humans that started this year in Mexico and traveled around the world. Although this strain of H1N1 virus did not end up being as terrible worldwide as originally reported by our media, the devastation to the swine industry was solid. Public perception makes a difference.

It is possible and more than likely that pigs, people and birds are going to continue to exchange strains of influenza. And in this podcast, we are going to discuss SIV and take a hard look at the potential for future zoonosis and then discuss what we can do as veterinarians to minimize it.

I'm pleased to welcome Dr. Jim Lowe to this Podcast as our main speaker. Jim, you've given us some feedback on diseases discussed in our other leadoff podcast on TTV, but today you are on the hot seat. I know you've been involved with some research recently on SIV zoonosis and I'm looking forward to hearing your thoughts. After Jim, we will hear reactionary comments from Drs. Connor and Hollis. Jim, you're up.

Jim

Thanks, Sarah. Although this hasn't been a typical subject that we think about day in and day out, the recent novel H1N1 virus has brought this topic to the forefront, giving us something to think about all day and even some of us have nightmares about at night. I know in the news that novel H1N1 began to break, I had to immediately switch gears and think influenza non-stop all day. It really showed me how we have to get back into damage control mode and how if we'd been maybe a bit more prepared as an industry it certainly would have been easier.

With that said, I know we are all exhausted by the topic of pandemic influenza. Ahhhhh! Well, at least I am. We knew it would be scary, but when you don't know when or how something is going to occur it's certainly hard to prepare. Who would have guessed we'd have a type of flu attributed to swine in the human population and no positive pigs anywhere until an exposed human traipses back from Mexico, walks into a bunch of pigs in Canada, and infects them. Now besides the fact that we may be of challenged that theory afterwards, it certainly is a model that we're concerned about in the rest of the industry.

What it really did show me though is that what it does to public perception of pigs and its devastating impacts on the pork market. Really, if you think about it, this time we were lucky. The virus certainly doesn't appear to be that bad, but it didn't really keep people from being convinced that pigs were the issue. In spite of some really outstanding efforts by everyone in the industry, certainly National Pork Board, National Pork Producer's Counsel have shown some real leadership on this issue. Many people in the general population may never know that this novel H1N1 that the media called "swine flu" and I jokingly referred it heard to as "CNN flu", which I actually think maybe is the best name, was not found extensively in pigs or really at the end of the day a first in pigs in our knowledge.

But, now we know that the threat of an influenza break blamed on pigs is real in today's world. It has the potential to happen and will likely impact us greatly as veterinarians.

Sarah

So, Jim, I want to get back to this novel H1N1 eventually, but first, what is the **real** potential for an influenza pandemic leapfrogging from pigs to people?

Jim

Yes, Sarah, that's the question to answer. So, let's dive into the literature a little bit. There is certainly a tremendous amount of literature supporting the potential for human influenza pandemics in its origin in non-humans for the source of those pandemics. There is a fair amount of literature that is certainly controversial in regards to the primary driver for influenza pandemics, how much risk swine in swine workers really are to human health. Now as a disclaimer, I am certainly not a medical doctor and probably have highly biased views being a swine veterinarian, but the basic of what comes out of the literature are pretty clear with a little bit of common sense. I'll try to paint that picture.

You don't start any conversation of influenza in humans without talking about the 1918 pandemic. This was the mother lode of all influenza viruses. We have had pandemics since in really multiple times. In the U.S. we have had pandemics, but none as pathogenic or as awful as 1918. There is a great book that I would encourage you to read, and in spite of my nerdy tendencies this one's really not too nerdy. In fact, I think you'll enjoy it, especially considering the relevance with the novel H1N1 this spring in 2009. It's called *The Great Influenza*. It has a great discussion of the social factors, which may have driven both the virulence of the virus and the worldwide spread in such a rapid fashion. As I read it, the key take home from the book was that 1918 was really a unique time. We had a novel H1N1 influenza virus introduced. But in addition to that, the social conditions on the front during World War I along with the tremendous crowding of the troops in the small barracks in the U.S. amplified the virulence of the virus and allowed a highly virulent virus to transmit very, very, very rapidly between highly stressed and susceptible individuals. Nothing like a bunch of troops crowded into tight conditions with stank air for six weeks to find out how much disease we can generate. Sounds like some continuous flow situations to me! Thank goodness for all in/all out!

Sarah

Jim, what was different about this 1918 virus?

Jim

In 1918, we had a new virus introduced. It evolved very, very quickly. Ooh yes, the evolve word and evolution certainly does play a key part in this disease. The ecology in which the virus is allowed to evolve certainly can be a predictor or can at least influence the outcome of both virulence and ease of transmission. So, what do we know about that virus? The work published in *Science and Nature* in 2007

strongly implicates that the virus was of avian origin and it was passed to humans. There have been some papers published since then that argue against that, against its origin in birds, but I think the scientific community stands by the original work. Certainly, these papers make my head hurt when I try to read them as they are often in excruciating detail of the molecular biology. But, as near as I can determine from reading, there are some minor arguments about how the authors, the original papers came to the data... and merely that maybe the original scientists claiming avian origin of the flu were being a bit hasty. But, I don't see anyone who has produced any data suggest it was not an avian origin virus.

So, what is the good news? Pigs taking the blame for the 1917-18 pandemic is really likely a myth, but nevertheless, this is how pigs were originally infected with H1N1, human transmission to pigs in the 1918 flu break looks like the origin. Most likely, the virus went from birds to humans to pigs.

Sarah

For this recent novel H1N1, animal rights activists and others tried to pin modern swine production as the perfect vehicle to create this virus and infect the world. So, 1918 seems like a long time ago. Is there a reason we see flu originating in Mexico, Hong Kong, rural Asia? I guess what I'm trying to get at is what type of swine production has the potential to create the next pandemic in your opinion?

Jim

Yes, you say, Jim, we don't have World War I going on today. We certainly don't have people crowded on the troop transports. Maybe those social conditions don't exist for the emergence of a new virus. Ahhhh, but oh my friend, we still have a tremendous amount of crowding in this world. If you look at the conditions in many developing countries, particularly slums, really not much different today with the kind of human contact we see there than what we saw in World War I. Worse yet, culturally in many societies, livestock and pets capable of being infected with influenza live in intimate contact in these densely packed human neighborhoods. The rearing of pigs, chickens, and ducks in the same house as human certainly presents a greater opportunity for animal to human transmission and vice versa of influenza virus than we see in most modern swine operations.

Sarah

So, you would say we are at risk of another human pandemic rising from one of these neighborhoods in developing countries?

Jim

Yes. Is it going to happen tomorrow? Don't know. But, I do think if you review the literature and the current social conditions in many places of the world, we have the potential to develop zoonotic virus, which could become pandemic with respect to human-to-human transmission very quickly.

Sarah

Okay, Jim, I think the next question that begs to be answered is what do we know about transmission from animals to humans?

Jim

Webster, in 2002, published a nice paper along with his colleagues at St. Jude's that suggest yes, in fact, we do have somewhat frequent transmission of influenza virus from lower animals into humans. Okay, no pot jokes about the veterinarians are lower humans, but we will work through that with our nutritionist friends. But, we can't quantify that because we really have an inadequate surveillance

system. When we look at the data in frequency of zoonotic transmission, prediction of the next zoonotic outbreak is nearly impossible.

But, as a cynic that leads me to one other thought: without data, fear mongering is quite easy to do. There is no data to refute what is going to happen. One can sit back and say, "A pandemic could happen." But, the real question is how likely is it to happen? The data today would say that we don't know. Should we err on the side of caution? Hmm, yes. Should we lose sleep at night thinking the world is coming to an end? Probably not, but certainly the data to assess the true risk of pandemic zoonotic influenza virus is not there.

We do know, however, that changes in husbandry methods or rearing conditions can be exceptionally important. As we discussed earlier, many cultural practices in developing countries would have tightly packed people cohabitating with species that could be infected. If you look at the data from the highly pathogenic avian influenza outbreak in 2002 from Hong Kong, it would suggest that separating waterfowl from land birds completely stopped the transmission cycle of the HPAI. It is important to remember that the waterfowl are the reservoir for these viruses. The domestic ducks were eliminated from Hong Kong, and then transmission to viruses stopped almost immediately. So, what does this really mean? Don't keep ducks in your house! No, no, no seriously. Here's the take home: the way we rear livestock today could have huge impacts on whether we have another pandemic. Alterations in rearing strategies could be important in the reduction of not only zoonotic influenza, but also pathogenic influenza viruses within species.

Sarah

Although Webster documented that cross species transmission is possible, Jim, do you think it's likely?

Jim

We don't have the surveillance data to estimate how often it happens, but Christine Van Reeth in 2007 during a research article, based really upon her genetic research, estimated that although it is possible, it is not very frequent or very easy for viruses to transmit between species. Why is this? Well, it takes major genetic changes to get the virus to change their host adaptation. In other words, for an influenza virus to live in pigs or birds and then go to humans is not a simple process.

Many of the mutants that are created are not very successful. Although we can get individual cases of zoonotic transmission, the genetic changes to allow human-to-human transmission of those cross species infections are exceptionally rare and difficult. Van Reeth suggests in her paper that there is clearly no proof that pigs were involved in the 1957 and 1968 pandemics and that based upon recent data, the 1918 pandemic either. Here's a quote from her paper, "The major conclusion is that cross species transmission of influenza viruses per say is insufficient to start a human influenza pandemic and that animal influenza viruses must undergo dramatic, but largely unknown genetic changes to become established in the human population."

So, while it can happen, the big take home message to me is, it doesn't happen very often and it is probably pretty hard. What's that information good for? It means that we as a swine industry don't have to spend a lot of time worrying about being the source of the next pandemic, but we might want to be worried about public perception.

Sarah

Ok, but people who work with pigs have greater risk of being infected correct?

Jim

Greg Gray and his group at the University of Iowa have done an extensive amount of epidemiology work on swine influenza virus infection in humans. He published papers in 2006, 2007, and again in 2008 all dealing with their survey work of swine workers compared to non-exposed controls. As I look at it, the basic take home of these studies is that swine workers are at higher risk of having I antibodies against H1 influenza virus. In the first study looking at H1N1 exposure, swine workers were 17 times more likely to be infected and slaughter workers 6.5 times more likely to be infected than their non-infected controls. H1N2 infections also appeared more often in swine workers but at half the risk of H1N1.

So, what does all this risk work tell us? Well, if you ask the question has there been swine-to-human transmission? Yes. Has there been human-to-human transmission? No, it doesn't appear to be. Does it mean it doesn't happen? Certainly not.

Kind of leads us to say that we could have issues with infection of swine viruses in people, but maybe the real concern needs to be about people infecting pigs. Why do I say that? Well, the current highly pathogenic Avian Influenza virus, often called HPAI, has been demonstrated that it does not infect pigs at a very high rate. Pigs appear actually to be lowly susceptible to current H5N1 HPAI. This work was done really by the group at the University of Georgia and Kelly Loggers group at NBSL. So, if pigs really aren't that susceptible, do we need to worry about pigs infecting people with avian influenza? Probably not, but we might need to worry about people infecting pigs with it.

Sarah

What action points should be gleaned from that information, Jim?

Jim

Dr. Gray and his group argue very effectively in two papers, one from *Emerging Infectious Diseases in 2007* and one in *Current Infectious Disease in 2006*, that vaccination of swine workers in the face of the pandemic is very important. Why? If people can spread the virus to pigs then there's an increased risk of mutation and pushing the virus in another direction. To protect both human and swine health, vaccination of swine workers is probably highly beneficial.

What else do we know? We know that simple infection control procedures are highly efficacious in lowering the rate of infection. Dr. Gray's article from *Emerging Infectious Diseases in 2007*, he demonstrated that people who wore gloves continuously in swine barns or did not smoke were at significantly reduced risk of having antibodies to swine influenza virus. Does this make sense? Sure does to me. By not getting influenza virus on your hands, you were less likely to wipe your mouth and nose with your contaminated fingers. Smoking certainly makes sense because the damage to the respiratory cilia cells allows easier access for the virus, and nevermind that smoking requires you to put your hand up against your mouth repeatedly.

One might wonder if swine vets actually have a lower rate of antibodies than swine workers merely because we tend to wear gloves when handling infected animals during necropsies. Maybe it suggests that we all need to work harder on wearing gloves as veterinarians so that we are not infected at all, but all together it would suggest that very simple infection control procedures among workers could be effective in lowering the risk of interspecies and within species transmission.

Sarah

Ok, a ton of great information and ideas to think about, but could you wrap it up conceptually for me, Jim.

Jim

Influenza viruses can cross species. Fire is hot and water is wet. Okay, that's obvious right? Does it appear that viruses cross from pigs to people very successfully? Well, no. But, it is really hard to know for sure. It is also very hard for the virus to host adapt and it does not appear that routine cross species transmission would cause a high risk of pandemic movement. We know that basic infection control measures can be highly effective in controlling the spread of the virus both within and between species, aka, listen to your mother and wash your hands and listen to your veterinarian and wear gloves. Good solid infection control pay dividends.

What is interesting to me is that if you look at the human literature, this basic human hygiene is not practiced consistently even in hospitals, and the fact that simple procedures like this can make great strides in minimizing risk does not seem to be appreciated. We certainly know that getting your flu shot is probably beneficial. It doesn't block infection, but it limits the amount of virus you shed and the number of average days that you were sick, and also certainly lowers the risk of human-to-swine transmission.

I think finally, we as vets in agriculture, and yes, even the feather guys, need to have an effective lobbying strategy with government to help them understand that people working in our industries should be high on the list for any pandemic vaccine. Although our people may not be high risk of being infected, and that's a key point. It may not be that our people are going to get infected from the livestock, but they certainly could be high risk of shedding it to the livestock. And, anything that we can do to reduce that risk across species will be exceptionally valuable in helping control any pandemic.

Sarah

Excellent point, Jim.

Jim

So, I hope that this has been educational. Certainly, it's been long and drawn out and it is a broad subject and it's a little tough to get into 20 minutes. But, I hope you've learned a little bit more about potential risk factors for influenza transmission and maybe some ways that could be more effective controlling it.

Sarah

I did, definitely. Thanks so much, Jim. So, Jim, I'm seeing reasons beyond creating second hand smoke for reiterating no smoking rules in barns and I'm picturing more swine employees working with gloves. You know many farms strongly recommend SIV vaccinations for employees. It looks like this is still a good idea.

We'll get back to application in barn, but for now, Dr. Connor. I'd like to hear your response to Dr. Lowe's research. How do you see this information being applied across the worldwide industry? Does it matter if U.S. vets and U.S. employees make control measures to reduce transmission of SIV to pigs if people are living in close proximity to chickens and pigs in rural Asia? To me this sounds like establishing worldwide standards for human pig interaction.

Joe

Sarah, before I respond directly to your question, I wanted to recommend an excellent book. I really enjoyed recently reading *Evolution of Infectious Disease* by Paul W. Ewald. He takes a broad thoughtful approach discussing why viruses and bacteria change or evolve over time. The book discusses the influences of pressure that would accelerate or minimize this evolution... pressures ranging from population size to host susceptibility, transmission methods, antibiotic and disinfectant pressures. Pressures that we see every day in the pig production. The author provides data to support his conclusions and looks at both pathogens that have reduced virulence over time and pathogens that have increased virulence over time and what we can do to alter that pathway. It's a good read for any of you folks looking to expand more on this topic.

It is an understatement to say that SIV is an interesting virus. Jim, you've done a great job in reviewing the literature. With an agent such as influenza, we have to consider the transmission of the virus between human's and pig's and vice versa. Jim, your review of the literature clearly establishes that human pig transmission does occur. The literature links that all of the swine influenza viruses most likely originated from humans, and thus control needs to be on a radar screen. Any infectious agent in a protein commodity business as we've recently seen affects export sales and domestic consumption.

We have to be concerned about activities around the world because of the international movement of people, products, and information. The spread of the recent novel H1N1 virus is one example. Recently, when I was lying prone in a dental chair and discussing influenza with the dental hygienist, she mentioned that she just recently returned from a humanitarian one-week visit in Honduras. She was the dental hygienist in a group of healthcare providers. In her conversation, I asked, "Were you in contact with pigs, chickens, and cattle?" Her response is, "Absolutely, the species were free roaming; and the majority of the people that I was caring for would have had contact with those species prior to standing in line. I enquired about what procedure she took on re-entry to the U.S. She did not perceive that there was any risk because she did not feel that she had been in direct contact with pigs or chickens since she had not actually handled them. It's another example of the need for us to educate, not only ourselves, but the general population of risk and maybe it is time to lobby for doctors to recommend SIV boosters prior to travel to foreign countries at least for people that may have close contact with pigs and chickens. Clearly, the media attention on this novel H1N1 virus can be a springboard for educational opportunities.

A key question, Sarah, if it does matter for us in the U.S. if we initiate control measures to minimize transmission of SIV to pigs while other areas of the world do not. We know that exports have been diminished and thus, efforts to minimize outbreaks should be in place in the U.S. production even if they are not yet accepted in other areas of the world. The data supports that we should recommend and insist not only the farm staff workers, but ourselves be vaccinated for human influenza and we should be more cognizant of staff and ourselves that develop flu like symptoms or syndromes both to minimize transmission to pigs and vice versa.

Jim, you point out some really basic procedures that we know are extremely helpful in minimizing transmission. We have taken the approach on farms of installing a soap disinfectant dispenser that the staff uses when they leave the office to re-enter the production area. These are very much like were present at the World Pork Expo. When we assess, actual compliance has been low, but it's an effort to initiate the process and to drive home that we can have an effect on minimizing transmission not only of SIV, but other potential pathogens.

So, Jim, a great summary. This virus is one that is becoming increasingly more challenging both from the transmission and the control.

Sarah

Thanks Dr. Connor. Wonderful insight there. I'm gathering my action points as I listen, but for now let's switch gears a bit. We've heard from both Drs. Lowe and Connor and heard them talk about interventions that they have recommended on-farm ranging from employee glove wearing to vet glove wearing to vaccination of humans working with pigs to the use of hand disinfectants before entering swine facilities. Dr. Hollis, let's say you want to create a comprehensive plan to prevent humans from transmitting flu to pigs in a large system. What would be your approach?

Bill

Thank you, Sarah. Well, I'm going to back up a bit and focus on the more prevalent pig-to-pig transmission. In regards to SIV, I would approach a comprehensive program by first starting with diagnostics to identify prevalence of pig-to-pig transmission within my swine farm population. And especially considering recent events, I think we as veterinarians must know the influenza status of each farm and that could take a lot more monitoring than we currently do.

With influenza, we have to anticipate activity levels in the spring and fall and separate the virus into different populations. So, with flu, I would plan for protection measure for gilts and sows on a consistent basis. That means a vaccination control program that limits the activity level of the sow herd and prevents leakage of the virus from the sow farm to the growing and finishing population.

Now in comparison to the sow farm, our growing pig populations are far more dynamic because of both the combination of pigs from different systems that can impact the movement of flu virus throughout the area and area spread, but we can also have multiple ages on some sites that continually reintroduce this new pig population that may or may not be stable to influenza. So, it's important that we evaluate these populations and that we know that we continue to re-infect these new younger pigs in some systems or in some locations. And, that we frankly strive to establish a more all in/all out site system or a single fill system wherever possible.

And, as for pig-to-pig transmission, a good program should still anticipate flu activity spring and fall and work to identify these new viruses. Viruses that we expect will emerge within our pig populations.

Sarah

Ok, Bill, thanks. Now, back to the question on what you would do to prevent humans from transmitting flu to pigs in a large system and vice versa.

Bill

Yes, that's the real question these days. First of all, I believe that the presence of human like flu has a high likelihood of continuing to move its way into our swine production systems. Therefore, every time we have a new break in our system it's important that we isolate that virus, that we identify its activity level, and genetically sequence it. So, we can compare this new virus to other influenza virus that we have within our system or viruses in our area.

Now the other concern, how do we prevent that activity from entering the farm in the first place? And, this is a challenge both for our HR departments as well as our production teams. I believe it's a reasonable request for HR to strongly request our employees be vaccinated for influenza at the direction

of their own healthcare provider. If our employees are willing to be vaccinated, that reduces the likelihood of a severe illness that lingers and brings forth new virus activity to the farm. Education needs to occur to increase this willingness and that's where you come in Sarah. We need a Training Toolbox lesson on why swine employees need to get vaccinated and re-vaccinated for swine influenza virus every year.

We would still expect that our employees are going to carry swine influenza virus on-farm on occasion and in our commercial settings and growing pig populations, we are going to work hard to prevent sick people from coming to work. It's still necessary that we encourage vaccination and that our employees recognize that our flu vaccine in the human population could actually work to reduce virus movement into the pig populations. The pigs that are in their care would benefit from their own healthy control of influenza.

Also, Sarah, it's in that lesson that we need you to create, we need to show other control measures including educational programs on influenza to increase worker compliance with personal protective equipment such as gloves and hand sanitizers. Further control can be gained by maintaining farm workers on a priority list for annual and pandemic influenza vaccines.

Sarah, it comes down to diagnostic control programs for the anticipated movement of flu throughout the season. A good HR relationship with our employees will also help them to understand the activity of the virus within both the human population and the swine population and encourage vaccination in those sensitive pig populations that may create a greater amount of risk to the whole growing pig system.

Sarah

Great, Bill. Thanks so much! You've given me a lot to think about when talking to production systems about human-pig SIV control. Dr. Lowe, Dr. Connor, Dr. Hollis, you've helped me make my action points.

From what I've heard, I've pulled together four action points for myself as a swine veterinarian. 1) Each farm I work with needs to have clear guidelines for control of human-to-swine flu transmission and vice versa. These should include yearly employee vaccinations, use of hand sanitizer before entering the barns, glove wearing, and routine hygiene. 2) Employee education needs to be done to increase the willingness to comply to these rules, especially the influenza vaccination recommendation. For example, you can have the flu clinics, but we can't force participation. 3) Should we consider lobbying to ask doctors to suggest SIV vaccination to humans prior to foreign travel? I think so. And, encourage more education of people who are going to have contact with birds and pigs internationally? Yes, absolutely. 4) We need to continue to monitor for on-farm control and the more common route of flu transfer, pig-to-pig. I appreciate the information I learned in this podcast. It will make me a better swine vet.

To get more action points from the field, tune into our next P's in a Pod where we talk about PCV2 maternal immunity and vaccination strategies for PCV2. Dr. Laura Greiner is going to present some of her research and research of others in the industry. Drs. Connor and Lowe will talk to us about the information's application to us as swine vets and we'll come back to you with another list of action points for yourself and the farm. Drive safely and have a great day!