

H I G H L I G H T S O F A R O U N D T A B L E D I S C U S S I O N

Lightening the Load

TEAMING LIVE PRODUCTION WITH PROCESSING

TO MEET USDA'S NEW LIMITS FOR FOODBORNE PATHOGENS



A U G U S T 2 0 1 6 • S A N A N T O N I O , T E X A S



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W E L C O M E

Let's begin with the good news: According to a report released in 2016 by FDA, the prevalence of *Salmonella* in retail poultry is at its lowest level since testing began in 2002. More specifically, in retail chicken, the incidence of *Salmonella* dropped from 15% to 9% from 2008 to 2014.

The National Chicken Council attributed most of these reductions to "strengthened sanitation programs, temperature controls and various interventions in both first and second processing." But as we know, one outbreak of *Salmonella* and other foodborne pathogens is still one too many.

2016 was also the year USDA raised the bar and introduced new standards for *Salmonella* and *Campylobacter* in ground

chicken and turkey products, as well as in raw chicken parts — specifically, breasts, legs and wings.

While it's clear the US poultry industry has made great strides in reducing foodborne pathogens, USDA is clamping down and asking poultry companies to do even more. However, one segment of the poultry chain can't do it all. It needs to be a team effort, particularly between live production and processing.

Looking to help the industry meet this challenge, Zoetis drew on its expertise in poultry health and food safety to organize this roundtable. We're grateful to our distinguished panel for their insightful contributions to this lively discussion.



-
- 4 Panelists
 - 6 The relationship between processing and live production
 - 10 *Salmonella* management in breeders
 - 12 *Salmonella* management at the hatchery
 - 16 *Salmonella* management in broiler production
 - 18 Biosecurity and foodborne pathogens
 - 22 Alternative products for managing foodborne pathogens
 - 23 Poultry feed as a source of *Salmonella*
 - 24 Closing in on *Campylobacter*
 - 26 The poultry veterinarian's role in food safety
 - 28 Customer education
 - 29 Sleepless nights



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MARTY EWING



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THE RELATIONSHIP BETWEEN PROCESSING AND LIVE PRODUCTION

“ ...I've seen a change over the last couple of years. There's more communication, more teamwork. ”

SHANE CALHOUN



Let's talk about processing — the segment of poultry production that has traditionally borne the brunt of managing foodborne pathogens in products shipped to retailers, institutions and consumers. Is that still the case or are other segments of the poultry chain getting more involved?

CALHOUN

You're absolutely right — it was always the processing plant's responsibility, but I've seen a change over the last couple of years. There's more communication, more teamwork. The processing plant knows more now about what's coming into the plant and about things like proper feed withdrawal — certain aspects I never dealt with in quality assurance 2 years ago. I think this is a key point. The mentality seems to be different on the live side, which has really stepped up its game, largely due to the presence of USDA within processing facilities.



Dr. Singer, you've done a lot of work with modeling and evaluating interventions for foodborne microorganisms. What have you found regarding the relationship between live production and processing?

SINGER

The projects I've been involved in — and where I think there's a lot of room for improvement — is what was just described and that's the relationship between live production and processing. We've tried to predict what's going to be coming into the plant and to prepare for those loads of foodborne pathogens, because it's a lot easier to reduce a lower load of an organism than a high load. If it were possible to actually predict what was coming in, it would make life at the processing plant more manageable. There's a lot of work to be done in this area.

With a good monitoring system in the plant, you could understand the risks of your product going out the door. This is where I would encourage companies to



THE RELATIONSHIP BETWEEN PROCESSING AND LIVE PRODUCTION

focus — understanding the risk in the plant. In my opinion, you're not going to be able to rely on FSIS sampling to predict those risks.

O'CONNOR

I agree. There's more reliance on processing because the interventions can be implemented faster. The measurement of interventions in the plant is also easier to do than on the live side, where you might have to wait 45 days for a broiler flock to grow out before you can tell if you've had an effect on *Salmonella*.

EWING

I think that's part of what USDA is trying to accomplish with the new poultry-inspection system, because just looking at chickens doesn't do any good. Currently, for every 22,000 carcasses processed, industry is required to test one carcass pre-evisceration or pre-chill and one carcass post-chill to assess process control. USDA, on the other hand, is supposed to test only one carcass a week at post-chill to verify process control. As the *Federal Register* is currently written, any plant can be categorized using as few as 11 samples. In other words, if USDA has taken 13 samples over the past 52 weeks and one was positive, then that plant is in Category 3.

That being said, we try to anticipate the quality of the poultry coming into the processing plant, and maybe we can correlate that to the pathogen load. Surely a good, healthy flock is going to have less microbial contamination than a sick one. But there are always surprises, so we have to assume our flocks are 100% positive and treat them all alike. Heaven forbid if an outbreak occurred and could be traced back to that day's production when one flock was processed differently from another. There's liability to consider.

We need to remember, too, that if we start claiming on-farm interventions for pathogen control, we could end up having to let USDA validate them, and that's opening ourselves up to more USDA inspection, possibly at the farm.

SMITH

By and large, from what I've seen, processing plants meet USDA standards pretty well, although there are incidents you don't expect — those that come from out of left field. For example, sometimes you have flocks that come in with a very high pathogen load, one that's higher than what the plant's set to reduce. There probably are things we can do in the plant

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THE RELATIONSHIP BETWEEN PROCESSING AND
LIVE PRODUCTION

“ USDA does not have the intimate knowledge you do of what happens in a plant and what you can do, realistically, to control *Salmonella*. ”

DOUGLAS FULNECHEK, DVM

to make further improvements, but I don't know that we can ratchet up our in-plant control procedures enough to meet a more stringent standard. Live production may need to play a bigger role.

 KECK

Dr. Singer, what are your thoughts on the performance standards established by FSIS?

SINGER

The performance standards confuse me, both new and old. They are stated as being a form of process control, but they are absolutely not designed to assist with process control. There is no way that a single sample per day or a single sample per week can predict a spike in the foodborne pathogen load that can occur within a single day or over a few successive days.

If companies don't have their own in-plant monitoring system for foodborne pathogens, they will have no idea how many servings of product are going out the door that represent a real public health hazard. Nobody should be relying on the performance standards to determine the risk of their product or the soundness of their in-plant interventions.

 KECK

So, do we need to go back and reinvent the methodology or redo the standards for chicken parts? Does the fact that FSIS has now implemented a parts standard indicate that it's willing to make changes?

EWING

Perhaps a different question needs to be asked. Does USDA have a realistic expectation of what the industry can do with a *raw* product that's not subjected to a bactericidal kill step as determined by time and temperature?

FULNECHEK

Salmonella is ubiquitous in our system. USDA does not have the intimate knowledge you do of what happens in a plant and what you can do, realistically, to control *Salmonella*.

WILLINGHAM

To me, it's a disservice that the government is placing on the industry. The consumer is being led to think that all [raw] chicken can be safe. The consumer needs to think every chicken — to your point — has *Salmonella*. That's the only safe way to handle it because we don't know which ones have *Salmonella*. Why do we push for some metric that leads the consumer to think it's safe



when it's not? It would be better to tell consumers to buy a thermometer and stick it in the chicken to see if it's cooked.

O'CONNOR

The industry and government could both do better, in my opinion. I think a performance standard for a known pathogen creates a conundrum. It sets a standard by which a processor is able to "leak" a pathogen into the marketplace. Subsequently, the processor only finds out that this leakage is a problem when illness becomes attributed to them. I view that as reacting to an "open door, after the horse has left the barn." It creates confusion. If a bacterium is a pathogen, how do you safely allow some of it into commerce? I believe if tolerance is allowed, it should be measured using quantification testing, not prevalence (presence/absence). In that way, the risk to consumers could be meted out rationally, using real levels that measure the amounts of bacteria that may be entering commerce. This is just my thought; the practicality of it might be more difficult than I make it sound.

In the scenario I described, where processors are able to release a specified prevalence of *Salmonella* into the marketplace, I think the industry needs to be more active in messaging to consumers about safe-handling practices. The "just cook it" message does not have an impact on the real problem, which I see as mishandling. If people grasped that message, in my opinion, a lot fewer cases of sickness would occur.



KECK

What about the argument that such messages could make consumers afraid of chicken?

O'CONNOR

I'm not afraid to drink beer, but I would not drink beer and drive. Reason being, the alcohol industry did an excellent job of changing consumer behavior with negative messaging: "Don't drink and drive" or "Friends don't let their friends drink and drive." That's saying the product has a certain downside. If you use it imprudently, it can harm people. But people largely accepted and integrated these messages, and the number of drinking and driving fatalities was reduced dramatically.

I'd like to see if the poultry industry could come up with a message to consumers that our product may contain *Salmonella* — so here are the appropriate steps for handling it such that you or your family don't become ill due to mishandling. I realize that some folks are hesitant to ascribe any negatives to the product, but I believe it would go a long way in reducing illnesses related to the bacteria that may or may not be on the raw meats purchased by consumers. Just my opinion.

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ERIC WILLINGHAM, DVM

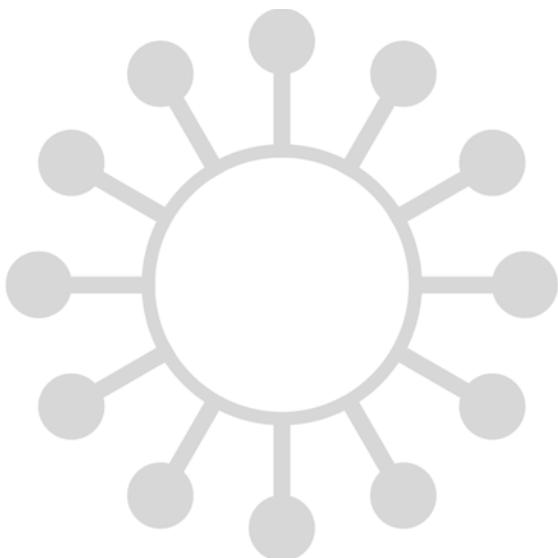




SALMONELLA MANAGEMENT IN BREEDERS

“ The other big issue is vaccine administration. You've got to get these vaccines into the chickens for them to work. ”

JOHN SMITH, DVM, ACPV



We talked earlier about making an even greater effort to reduce *Salmonella* coming out of live production. So, let's begin with the breeder flocks and the role of vaccination. Dr. Smith, is it true that the large majority of breeders in the US are now vaccinated against *Salmonella*?

SMITH

I have some recent data here from Georgia, where only 9% of broiler complexes aren't vaccinating their breeders against *Salmonella*. That means 91% are. However, among the ones that do, there are 10 different programs. In some instances, only one killed vaccine is used, and in other programs, there's a combination of one or more live plus one or more killed vaccines.

We don't know what the optimum program is, but we know that vaccination works. It's a tremendous aid, but it's like we all say so many times — there is no silver bullet and vaccination is not a silver bullet, either.

The big issue, of course, is all the various serotypes — and there is a limited number you can put into a bottle. So, the challenge is choosing the correct ones. Most of us try to target the big food-safety ones — the Heidelberg, the Typhimuriums and maybe Enteritidis. But we see a number of other serotypes too, and they're prone to change over time. That's an issue.

The other big issue is vaccine administration. You've got to get these vaccines into the chickens for them to work.

FULNECHEK

Of all the tools I've looked at over more than 20 years, vaccinating breeders for *Salmonella* has consistently had benefit. Because you're protecting the breeder, and by providing some immunity, she has less colonization and sheds less. Less shed means less potential *Salmonella* on egg shells. With the inactivated vaccines, you're also getting maternal antibodies to broilers so they have protection. Breeder vaccination is probably one of my first choices or lines of defense.

SMITH

The other point to consider about *Salmonella* vaccination of breeders is that it's not like vaccinating against bronchitis,



SALMONELLA MANAGEMENT IN BREEDERS

where if I find the right bug and put it in the vaccine, it stops the clinical disease. With *Salmonella*, the whole system gets contaminated, so you've got to stick with vaccination for a while.

As veterinarians, we need to realize that and then convince our production managers and upper management that it's not an immediate process. They want *Salmonella* stopped immediately, but it takes time and effort.



KECK

Dr. O'Connor, what was your experience with vaccination before and after the *Salmonella* outbreak?

O'CONNOR

In 2014, during the outbreak, I was asked if our breeders were vaccinated against *Salmonella* Heidelberg. I said, "Yes, they have been since 2006." So, we've been vaccinating our breeders with an autogenous vaccine for a very long time. I'd call it a partial insurance policy. Folks outside the industry need to understand that. It's overly optimistic to put all your weight on vaccination for solving the *Salmonella* issue.



KECK

Dr. Willingham, in your consulting work with different segments of the poultry industry, how do you go about designing vaccination programs and what's been your experience?

WILLINGHAM

Bacteria is a numbers game. There's no way I'm going to get 100% of birds in a flock vaccinated. For that reason, I believe in at least two vaccinations. It gets you closer to 100%. But Dr. O'Connor is right — you can't vaccinate your way out of it because you're never going to protect 100% of the birds. In a best-case scenario, you're vaccinating 90%. The remaining 10% can get the bacteria and that's a problem.

Consider too that any vaccine has a threshold and can be overwhelmed by *Salmonella* in the environment. In the programs I design, I emphasize using a killed versus live vaccine, and I request two of them, because that way, I know it's humans vaccinating each bird and more birds are likely to be vaccinated.

FULNECHEK

Although I've seen *Salmonella* vaccination of breeders give consistent results more

often than some of the other tools, I agree that if the *Salmonella* load in the environment is too high, it will overwhelm the vaccine.

One point we need to make is that with *Salmonella* testing, it's either positive or negative. There's not a quantitative value put on it.

WILLINGHAM

When it comes to the plant, yes.

O'CONNOR

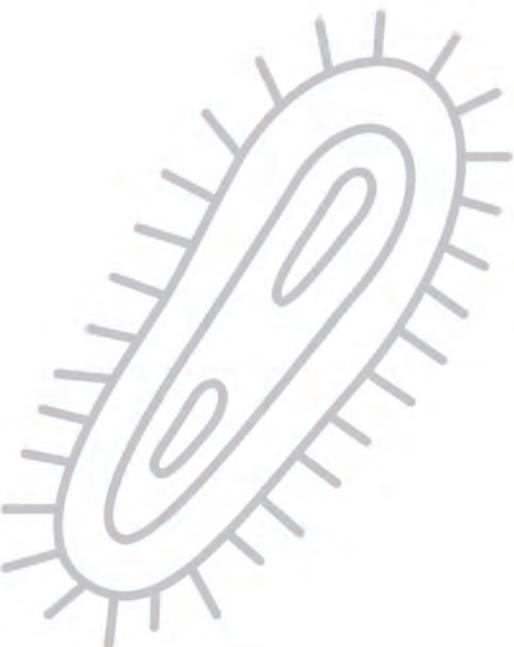
I agree with Dr. Willingham's point about *Salmonella* being a numbers game. From a food-safety standpoint — specifically, if we're talking about the final consumer's risk of becoming ill — using enumeration to measure pathogens would be a lot more meaningful than saying the pathogens are present or absent. We need to know the actual pathogen load. Is there 1 cell or 1 billion cells? Simply saying they're present or not present doesn't correlate to the risk to the consumer, in my opinion. Quantification, on the other hand, would do that.

SMITH

A *Salmonella* Kentucky gets you the same black mark that a Typhimurium or a Heidelberg gets you — regardless of human-food safety.



SALMONELLA MANAGEMENT AT THE HATCHERY



“ If you change factors affecting the ecology of different *Salmonella* strains, you will see changes in the dominant strains that are growing and persisting. ”

RANDALL SINGER, DVM, MPVM, PhD



For many years poultry companies used an antibiotic such as gentamicin in the hatchery to reduce the risk of bacterial infections resulting from *in ovo* vaccination. Now some producers are moving away from that. To what extent is that happening? And is this trend affecting levels of *Salmonella* or *Campylobacter*?

SMITH

About 15% of the market now is raised without antibiotics (as of 2015). So clearly, that segment is not using antibiotics in the hatchery.

Intuitively, you would think that eliminating antibiotics from the hatchery increases *Salmonella* shedding, and some surveys indicate that organic and free-range poultry are as heavily or more heavily contaminated than chicken raised with antibiotics. There is possibly some indication that *Salmonella* isolated from organic poultry and poultry raised under the “no antibiotics ever” label have less drug resistance. So, there might be a trade-off — increased shed but less antibiotic resistance — but we don’t really know.

SINGER

My concern is not necessarily that there would be increased shedding, but that we’re going to see a shift of the dominant *Salmonella* serotypes and strains. Think about the pressure the antibiotic puts on *Salmonella* that’s coming vertically through the system; you would expect it to be strongest against serotypes or strains that are pan-susceptible or at least susceptible to the antibiotic you’re using in the hatchery. Say it’s susceptible to gentamicin and, in the past, to third-generation cephalosporins. Now, without that hatchery antibiotic, *Salmonella* strains are no longer under that pressure and have the ability to compete equally in the grow-out facility.

Consider too the serotypes that tend to be the most susceptible to all antibiotics. Take Enteritidis, for instance. It’s pan-susceptible and almost always susceptible to the antibiotics we test it against. If this theoretical model is valid, I am concerned that as we remove the hatchery antibiotic, we’re going to see spikes in *Salmonella* Enteritidis.

We’ve seen serotype replacement before in the poultry industry, so this idea is not necessarily novel. But if you change factors affecting the ecology of different *Salmonella* strains, you will see changes in the dominant strains that are growing



SALMONELLA MANAGEMENT AT THE HATCHERY

and persisting. I don't know if this is a good or bad thing.



KECK

What else could be done at the hatchery level to contain *Salmonella*?

SMITH

This may sound dull and boring, but we all know that egg-nest sanitation — as well as procedures for egg gathering and grading and preventing eggs from sweating — are important. Egg coolers need to be kept clean. Rodents need to be kept out. The temperature, detergent and disinfectant levels in your box washers and tray washers need to be watched. Hatchers and processing equipment need to be kept clean.

It's the same thing that we find in antibiotic-free production. You've just got to get serious and pay attention to details. I don't know of any amazing product or procedure you can apply.

Let's remember that *Salmonella* are fecal bacteria. They live in feces. I don't know if anybody's ever looked at it, but I would hazard a guess that most of the *Salmonella* that makes it through to

broilers probably comes from the egg shell more than from transovarian transmission. There is research indicating that *Salmonella* is probably on the egg shell. That would imply that with good eggshell sanitation and hygiene, *Salmonella* doesn't get into the chick when it hatches.

O'CONNOR

When we removed gentamicin from the hatchery, we did see a 0.5% increase in first-week mortality — depending, usually, on the age of the breeder flock. However, we haven't seen a difference in drag-swab numbers for *Salmonella*.

I'm not disagreeing with Dr. Smith. In the beginning of my career, I worked a lot in the hatchery; hatchery quality control used to report to me. I think many hatcheries could improve on sanitation. But in our operation, going off gentamicin hasn't had a big impact.

EWING

Our company has looked long and hard at the issue of removing gentamicin. We decided at this point not to do it. During vaccination of the chick when it is still in the egg, we deliver one small dose of

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SALMONELLA MANAGEMENT AT THE HATCHERY

“ We've been using hydrogen peroxide in a timed aerosol in the hatchers for as long as I've worked at Foster Farms. ”

ROBERT O'CONNOR, DVM, MAM

gentamicin, typically only onto the shell membranes, and the bacteria that may be in that egg are never going to see gentamicin again. This single dose has been shown to improve livability by at least 50% during the first week of life. That means half the number of chicks die from bacterial infection. Also, how much selection for resistance can happen with a one-time single dose?

SINGER

I'm still unable to figure out the effect an *in ovo* antibiotic has once it enters the broiler house. Let's say you're giving 0.2 cc per egg of gentamicin to 25,000 eggs. That's 5 g of gentamicin, but how much of this, if any, is going into the broiler house? Is most of the antibiotic discarded with the shell? We don't know how much of the gentamicin is entering the broiler house, how much is completely metabolized, whether it's excreted by chicks once they've moved to the poultry house or if there's any effect on poultry microflora in the poultry house.



KECK

What about fogging, washing, disinfecting or other methods of reducing potential foodborne pathogens from hatching eggs?

O'CONNOR

We've been using hydrogen peroxide in a timed aerosol in the hatchers for as long as I've worked at Foster Farms. I think it's an effective intervention. I remember doing a study involving a hatchery that wasn't plumbed to run hydrogen peroxide. The hatch fluff was many, many more times positive for *Salmonella* compared to fluff from hatcheries using hydrogen peroxide. In fact, the prevalence was about 85% without hydrogen peroxide versus maybe 20% or 10% in the others. So, I feel it works.

SMITH

It's my impression that using formaldehyde becomes very common in antibiotic-free production.

Formaldehyde is probably the only thing that will consistently knock the level of bacteria down. Because of worker safety, a lot of companies don't use it, but it will knock the level down better than anything else that I've ever tried. Hydrogen peroxide is probably the closest second.

O'CONNOR

The reason we use hydrogen peroxide is because, in California, formaldehyde is labeled for use in a poultry house but not in a poultry hatchery.

**SMITH**

I'll add that washing, sanitizing or fogging eggs is a controversial topic. There's a camp that says "don't ever wet the hatching egg." I tend to agree with that.

Part of the problem is that, if you think about it, most of the pathogens we're really concerned about are going to penetrate pores down to the shell membrane pretty quickly. If you're going to wash, sanitize or fog, it's probably most effective if it's done immediately upon egg collection — and that's fraught with grower-compliance issues.

I've looked at it over the years, and although I don't believe I ever harmed hatching eggs by washing or sanitizing them, I don't think I've ever demonstrated that I cleaned anything up or aided in the quality of our chicks by doing it.

“ Part of the problem is that, if you think about it, most of the pathogens we're really concerned about are going to penetrate pores down to the shell membrane pretty quickly.”

JOHN SMITH, DVM, ACPV



SALMONELLA MANAGEMENT IN BROILER PRODUCTION

“ There’s no black or white answer as to whether antibiotic-free production means a greater risk for the consumer. There’s just no good answer. ”

CHARLES HOFACRE, DVM, MAM, PhD

 KECK

Let’s turn to broilers and how production trends might affect the prevalence of *Salmonella*. Dr. Smith, in your experience, does antibiotic-free production affect the prevalence of this pathogen?

SMITH

The straight answer is, I honestly don’t know. There are articles in the literature — and they’re probably subject to some criticism as far as methodology — suggesting organic and free-range poultry operations raising chickens without antibiotics tend to have at least as high or higher carriage levels of *Salmonella* than conventionally produced chickens. If you accept any of these studies as valid, I think you could argue there’s some evidence these regressive techniques — or as a good colleague says, “raised without modern technology” — are not helpful in regard to food safety.

 KECK

What about secondary infections? Does the presence of other diseases affect *Salmonella* colonization?

HOFACRE

I conducted a study indicating that, by itself, necrotic enteritis does not make *Salmonella* colonization worse. But that was in a challenge model, not within a complex of 1 million broilers a week, where a lot of other things are going on at the same time.

At the University of Georgia, the late Scott Russell showed that birds with airsacculitis had poor uniformity as well as greater colonization of *Escherichia coli* and *Campylobacter* spp.¹

To me, it makes sense that if birds aren’t healthy, they’re going to have disparity in uniformity of body size. That’s a potential problem from a food-safety standpoint because equipment in the processing plant is set for a particular size. Birds that aren’t uniform in size have more nicked intestines and more fecal contamination; this can result in a greater opportunity for *Salmonella* or *Campylobacter* to be on the carcass.



SALMONELLA MANAGEMENT IN BROILER PRODUCTION

In summary, there's no black or white answer as to whether antibiotic-free production means a greater risk for the consumer. There's just no good answer.

SINGER

If you use an antibiotic, there's the risk that some bacteria such as *Salmonella* or *Campylobacter* could become more resistant, which would lead to more-resistant infections and potentially higher morbidity in people. But there's also the chance that by maintaining animal health, reducing subclinical illness and producing more homogeneity in bird size, you could potentially reduce product contamination and human illnesses.

At the end of the day, in my opinion, it's always better to prevent infections. One way to reduce foodborne pathogen levels in the plant is to reduce subclinical illness and overall disease in live poultry.



KECK

What about *Eimeria* resulting in coccidiosis or diseases that compromise bird immunity? Do these affect *Salmonella* colonization?

HOFACRE

There's research that shows *Eimeria tenella* can affect *Salmonella* colonization. *E. tenella* lives in the ceca, the same place *Salmonella* lives.

There's some evidence that infectious bursal disease will increase not so much the prevalence of *Salmonella*, but the load — probably things that affect cell-mediated immunity. Chick anemia would probably have an even bigger impact.

So, to answer your question — yes, we always need to do everything we can to control immunosuppressive diseases.

WILLINGHAM

Stress and cytokines are going to affect the gut population. We see that in all animal models. So, as we look at management practices, we have to ask how much bird density affects gut populations. And what about growth rates that put birds on the edge of that stress perimeter?

If we, as an industry, had lower density and a slower growth rate, would there be fewer issues with food safety? I don't know.

O'CONNOR

In the same vein, think about pullets on skip-a-day feeding and what that does to the GI tract. Does it potentiate *Salmonella* or other pathogenic bacteria? I'd like to see an academic study of that practice.

“ One way to reduce foodborne pathogen levels in the plant is to reduce subclinical illness and overall disease in live poultry. ”

RANDALL SINGER, DVM, MPVM, PhD





BIOSECURITY AND FOODBORNE PATHOGENS

“ I consider every farm a food-producing facility... I have to ask if it's a place I'd want to eat. That's the biosecurity metric that I use. ”

ERIC WILLINGHAN, DVM



KECK
We know that biosecurity is a big factor in preventing infectious diseases. Does it come into play in preventing foodborne pathogens? Can tightening up biosecurity procedures reduce a flock's pathogen load?

SMITH

We've all seen the diagram of the chicken house with arrows pointing to all the ways that pathogens can get inside — rodents, feed, water, wild birds and even the hands and feet of personnel. So, it certainly can't hurt to ramp up biosecurity to help prevent all types of diseases. My guess is that biosecurity is a relatively small part of the picture, but it's one that needs to be addressed.

WILLINGHAN

I consider every farm a food-producing facility. If the farm has trash around, no bathroom and no place with hot water to wash hands, I have to ask if it's a place I'd want to eat. That's the biosecurity metric that I use.



KECK
When you encounter a farm with poor facilities and biosecurity, what do you do? Go to the top floor and try and convince executives they need better facilities? And if so, what do they say?

WILLINGHAN

I have been successful in eliminating the bottom, dirtiest facilities. I tell them, "That's the farm that's going to cause your name to be in headlines. It's not going to be that farmer's name. It's going to be your corporation's name."

SINGER

That's an important point. If there's a lesson to be taken from the Danish experience [eliminating or minimizing *Salmonella*], it's that they eliminated probably the bottom two-thirds of their pork producers. We wondered how the Danish swine industry was able to increase production after eliminating in-feed antibiotic growth promoters. Well, they got rid of the worst producers.

There were over 25,000 swine producers before they started the process to ratchet



BIOSECURITY AND FOODBORNE PATHOGENS

down antibiotic use. Now they're down to between 5,000 and 10,000 producers. They have much larger producer operations but a lot fewer.

O'CONNOR

We had experience with a pullet house that was positive for a serotype of *Salmonella* that could pose a threat to humans. Despite treatments, it persisted. It went from the pullet farm to the breeder farm, but it was always isolated to that one breeder house and not disseminated to the other seven on the same farm.

We decided to follow a Danish-type model in that situation. We isolated every single house on that farm and initiated strict biosecurity measures, and that serotype never left that breeder house. A lot of what we did was based on Dr. Hofacre's advice, which really helped us. At least we didn't disseminate this *Salmonella* throughout the whole breeder farm.



KECK

Dr. Hofacre, what else needs to be done on the broiler farm to manage *Salmonella* and other pathogens?

HOFACRE

It's easy to provide a laundry list of things to do, but you really need to consider what needs to be done complex by complex and sometimes farm by farm. There's not one thing I could say that you should do across the board.

For instance, some farms may have a greater beetle population than other farms. For those complexes, the answer may be improved beetle control. On other farms, better litter management may be needed or rodents might be the primary problem. Sometimes, the soil can be a problem because certain *Salmonella* types will live in soil and, in the US, we have dirt floors, not concrete.

I will say that, in general, water disinfection for broilers is important. Also biosecurity, such as care when moving equipment from farm to farm. These are things that are just good production practices and will help contain all types of disease, including *Salmonella*.

“ It's easy to provide a laundry list of things to do, but you really need to consider what needs to be done complex by complex and sometimes farm by farm.”

CHARLES HOFACRE, DVM, MAM, PhD





BIOSECURITY AND FOODBORNE PATHOGENS

“ In our experience, new litter may not be an advantage. ”

MARTY EWING, DVM



KECK

What about litter management? Here in the US, I still see some complexes that clean out almost every flock, although that's the exception not the rule. At other complexes, they are hard-pressed to tell you the last time houses were totally cleaned out. Can litter management affect the load of foodborne pathogens?

EWING

In our experience, new litter may not be an advantage. New litter usually has a higher moisture level and the birds seem to be more susceptible to enteric disease, and we have had more of an issue with *Salmonella*. We had a tremendous time with *Salmonella* at one complex when it first opened, but now it's negative.

HOFACRE

If there is *Salmonella Enteritidis* in litter, then yes, maybe we need to remove it. But if we keep it out, it doesn't much matter if it's built-up litter or not. Built-up litter has better moisture absorption than new shavings. We never put back as much litter as we originally had, so you have much less capacity for water absorption.



KECK

Dr. O'Connor, can you speak to litter management on broiler farms with *Salmonella* where you started over?

O'CONNOR

Our outbreak involved 112 broiler houses in two complexes. That's a lot of chickens and a lot of litter.

In the case of those complexes, we believe the litter had a very, very high level [enumerated/quantified] of *Salmonella* so we needed to clean the houses completely down to the ground. Of course they were not "sterile," but they were as clean as you can make a dirt-floored house clean. They were broom-swept and there was no litter left in them. Standard cleaning procedures were used with water, soap and disinfectant, followed by fumigation with formaldehyde. That last step, formaldehyde fumigation, would not be considered "standard."

The decrease in *Salmonella* in subsequent flocks at processing was amazing. It went from 71% to 30% when measured post-picker. Parts in second process went from 30% to 1.7%. So, in this case, removing all that litter, cleaning,



disinfecting and using formaldehyde had a tremendous effect on *Salmonella* — and I think in that case it was very necessary.

That type of cleaning, sanitizing and fumigating is an enormous undertaking. We didn't do this to all our poultry ranches because we did not find *S. Heidelberg* on all of them, but we did intensified cleanouts when we found *S. Heidelberg* on specific broiler farms. That's a *Salmonella* serotype we don't really want to find. And right now we find little to no *Heidelberg*.

In particular situations, this type of "nuclear" cleanout is warranted. It's worth it for *S. Heidelberg*, but I would not recommend it for a poultry house that has a serotype that is considered non-pathogenic to humans, for example, *S. Kentucky*. You have to reach some sort of compromise from a business standpoint when it comes to the countless (~2,500) serotypes of *Salmonella*. How much are you going to push your economic envelope on interventions?



KECK

What about windrowing and composting litter as a method of reducing *Salmonella*?

EWING

Remember the situation I described earlier, where we had more of an issue with *Salmonella* in birds on fresh shavings? So, yes, cycling that litter and building it up helped us. We also did in-house composting. But it takes a little bit to get that litter "mature," if you will.

O'CONNOR

When we re-use litter, we compost it.

If my goal is to be absolutely, completely free from all *Salmonellas* or if you have inputs of the risky *Salmonellas* for humans — Typhimurium, Enteritidis, *Heidelberg* — then I recommend you use extreme cleaning methods such as disinfecting and even formaldehyde.

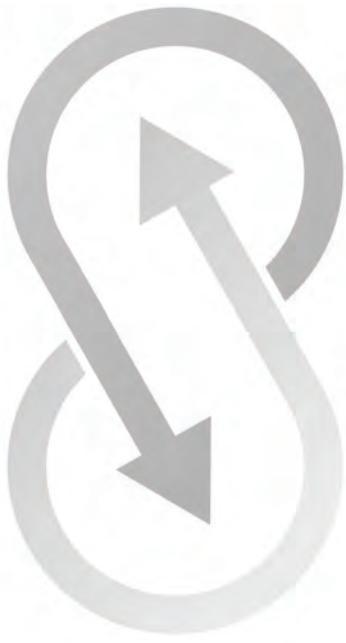
If my goal is to minimize risk, you're always weighing decisions about perhaps a multitude of things you can do to ameliorate that risk. In the case of litter, you compost and windrow and use litter amendments to try and kill/reduce the numbers of bacteria in the litter. You top-dress old litter with new litter to "dilute" the numbers of bacteria or viruses in the litter that a new flock will use.

“ If my goal is to minimize risk, you're always weighing decisions about perhaps a multitude of things you can do to ameliorate that risk. ”

ROBERT O'CONNOR, DVM, MAM



ALTERNATIVE PRODUCTS FOR MANAGING FOOD-BORNE PATHOGENS



“ In antibiotic-free production, there’s not one alternative product that we have used consistently, mostly because they’ve been so inconsistent. ”

JOHN SMITH, DVM, ACPV



KECK

What about alternative approaches like using competitive exclusion products, essential oils, prebiotics and probiotics or algae extract? Are they effective tools for managing *Salmonella*?

SMITH

I’m highly skeptical of those products. In antibiotic-free production, there’s not one alternative product that we have used consistently, mostly because they’ve been so inconsistent.

There’s evidence that competitive exclusion and live vaccines help in broilers. They’re more tools in our tool chest and, in some situations, it might pay to use them. But in my opinion, they’re not as effective or as important as breeder vaccination.

EWING

We’ve had a similar experience. Sometimes we can get good responses to competitive exclusion but not consistently.

O’CONNOR

I could never validate consistently that I was able to reduce or eliminate *Salmonella* through the use of alternative products. They are part of our toolbox and we do use some forms of alternative products, but confirming and quantifying their efficacy is difficult.

WILLINGHAN

When confronted with *Salmonella*, you’re not going to count on one thing. You do everything. So, when I have a positive house, I disinfect it and at the same time add some of these alternative products. I can’t do a controlled study in half a house, though, so I can’t say which one of those smaller tools was worthwhile.

O’CONNOR

We have to consider synergy. How does one thing we’re using affect the others? If we take one out, does it affect the efficacy of the others? Synergies are very hard to measure, especially on the live side.



POULTRY FEED AS A SOURCE OF *SALMONELLA*



KECK

Does feed play a role in the presence of *Salmonella*?

HOFACRE

The answer is yes, it can. I think feed can introduce a particular serotype into a complex, but I don't know that feed is a consistent source of *Salmonella* in broiler houses.

In primary breeders, yes, it's important, because you're striving for zero. If you have a naïve population and you get one load of feed or one ingredient that has a particular *Salmonella*, then, yes. I've seen the pathogen go all the way through to broiler flocks.

EWING

As long as we extrude it and pelletize it, it hits a temperature that should kill the *Salmonella*. Now, the problem is keeping it *Salmonella*-free and preventing recontamination once it's in the truck or on the farm.

O'CONNOR

When we have tested our finish feed — and this is not directly out of the pelletizing process, but a little bit further downstream — we occasionally find serotypes of *Salmonella*, but they are not the same as those we find in our broilers. I've never found Heidelberg in feed, for example.



KECK

Does the method of feed sampling affect results?

O'CONNOR

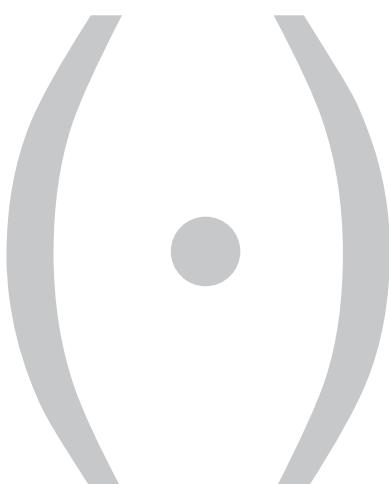
I have found that the best way to sample feed is by sampling dust in the feed mill. If you take a few dust samples on a regular basis from the top, middle, bottom — all throughout the feed mill — it's a pretty good indicator of what *Salmonellas* have potentially come through the mill. I've done that at a lot of companies over the years, and very, very rarely do you ever find *Salmonella* in the feed mill that you're also finding is a problem in the processing plant.

“ I have found that the best way to sample feed is by sampling dust in the feed mill. ”

ROBERT O'CONNOR, DVM, MAM



CLOSING IN ON *CAMPYLOBACTER*



“ We just don’t understand the epidemiology of *Campylobacter*. ”

CHARLES HOFACRE, DVM, MAM, PHD



KECK

***Campylobacter* is one of the organisms addressed in the new FSIS standards. We have highly effective disinfectants that can be used in processing. But to my knowledge, there’s not a poultry vaccine commercially available for managing it in live birds. So what, if anything, can be done on the live side of the business to control *Campylobacter*? Other than vaccination, is the approach any different from what’s done to manage *Salmonella*?**

HOFACRE

What we know about the epidemiology of *Salmonella* in the chicken would fill this room. What we know about it for *Campylobacter* wouldn’t fill that water glass.

On the live side, we don’t know why we often can’t detect *Campylobacter* until the birds are 14 to 21 days of age. We don’t know why it escalates so that birds are shedding unbelievably high levels at 35

or 45 days of age in one flock while in another flock they may all be zero. We don’t know why we may not find a single positive bird in a house, but the next flock in the same house is filled with *Campylobacter*. We just don’t understand the epidemiology of *Campylobacter*.

O’CONNOR

That has been my experience as well. I know of no validated intervention that is recommended for managing *Campylobacter* on the live side.

SINGER

I could suggest two things. First, raise a bigger bird. Older birds seem to have less *Campylobacter*. Second, move to Minnesota. For some reason our cold winters seem to knock *Campylobacter* down to nil.

O’CONNOR

We see a seasonal pattern with *Campylobacter*, or at least we do in the plant sampling. It tends to rise more so during the warmer months. But, even that rise is sporadic. I might see it in a particular plant only. Or, I might see it



CLOSING IN ON CAMPYLOBACTER

one year but not the next. There are still many, many questions about *Campylobacter's* ecology. I would agree about the size of bird. Most people in the industry who ask me about *Campylobacter* and are having problems with it are talking about a smaller 4.5-pound bird, not an 8-pound bird.

HOFACRE

There's a lot of work being done with *Campylobacter*, and I think we'll find interventions that work. I've done some studies with a few things that seem to have some promising benefits in reducing the shed. But I can't say that what works on *Salmonella* is also going to work on *Campylobacter*.

“ I could suggest two things. First, raise a bigger bird. Older birds seem to have less *Campylobacter*. Second, move to Minnesota. For some reason our cold winters seem to knock *Campylobacter* down to nil. ”

RANDALL SINGER, DVM, MPVM, PhD



THE POULTRY VETERINARIAN'S ROLE IN FOOD SAFETY



“ There is no vaccine that can eliminate *Salmonella* in live poultry. At best, we may be able to shift from one serotype to another. ”

MARTY EWING, DVM



In addition to protecting animal health and welfare, veterinarians take an oath to use their scientific knowledge and skills “for the benefit of society” and “the promotion of public health.” What exactly is the poultry veterinarian’s role in protecting consumers from foodborne pathogens? And is it changing?

EWING

Yes, the veterinarian is definitely being asked to assume an even bigger role. A lot more of my time is now devoted to writing almost legal-type documents to respond to government issues. These are either Noncompliance Reports or Notices of Intended Enforcement. They’ve been driven by consumer groups that are active in Washington and have a direct relationship with the USDA, which has to answer their concerns. It’s been my perception they think we can eliminate a lot of problems, including *Salmonella*, by just vaccinating, but they think we

just don’t want to invest the money in vaccines. And that, of course, is just not the case. There is no vaccine that can eliminate *Salmonella* in live poultry. At best, we may be able to shift from one serotype to another.

O’CONNOR

I would agree that a lot of our job now involves document review or writing documents.

Although the veterinarian’s role is going to depend on the company, I think poultry veterinarians are an excellent choice for a company’s conversations with customers, consumers and regulators as it relates to food safety. In the case of FSIS, I have found that vet-to-vet communication can be very productive.

Poultry veterinarians have a lot more interface with public relations than ever before and more than we were ever taught about in school. Over the past 9 or 10 years, we’ve become the point person or spokesperson for a company if there’s an issue regarding animal welfare, animal-welfare sabotage and antibiotic issues.



THE POULTRY VETERINARIAN'S ROLE IN FOOD SAFETY

HOFACRE

Within a poultry company, whether it's the turkey, broiler or layer segment, the veterinarian is probably the one who best understands the science and is most qualified to provide information. Generally, veterinarians have practice speaking to clients so they can usually speak with consumers or the news media in a way that can be understood.

SMITH

I agree that we, as veterinarians, may be the most qualified, but it seems that with a few exceptions, we're not called on to do it. More often, our role may be to try to help educate and prepare the person who is the spokesperson. It might be the CEO or someone else doing that job.

EWING

You're right. A lot of that has to do with company structure. If you have stockholders, you have to be very careful about the information you disseminate. And a lot of that has to be approved by an attorney. But some of us do field calls from consumers. It might be the young lady who calls and asks "Do chickens

have hormones?" and I have to explain that, yes, chickens have hormones but we don't add hormones.

WILLINGHAN

Fortunately, I think veterinarians still hold a respected position in the eyes of the public, but I think it's eroding if the consumer sees you as an insider, regardless of your honesty and integrity. It's an "us versus them" scenario. Consumers want to turn to an "us" person they think has more credibility, regardless of their knowledge. That's the issue, in my opinion; there are not enough animal-production and food-safety veterinarians within the consumer groups.

“ ...there are not enough animal-production and food-safety veterinarians within the consumer groups.”

ERIC WILLINGHAN, DVM



CUSTOMER EDUCATION



“ The industry would do consumers better if it would focus its messaging on the handling of raw poultry meat in the kitchen prior to cooking. ”

ROBERT O'CONNOR, DVM, MAM



KECK

We all know that proper handling of raw poultry and proper cooking could virtually eliminate foodborne illness due to *Salmonella* or *Campylobacter*. What can be done to improve customer and consumer education?

O'CONNOR

Improper handling by customers can be a problem and, in my opinion, more so than undercooking. I believe it's easy to say, "just cook it" when it comes to illnesses tied to poultry consumption. But I don't believe in the majority of cases, where illness is involved, poultry meat has been undercooked. The industry would do consumers better if it would focus its messaging on the handling of raw poultry meat in the kitchen prior to cooking. Bacteria is not visible to the consumer, so conveying a message of proper handling and avoiding cross-contamination can be more difficult than specifying a cooking temperature. You can measure the latter

with a thermometer, whereas appropriate handling of product throughout the preparation process is not measured with a data point.



KECK

I've seen surveys indicating that most people feel they don't have a good source of information about food and agriculture. Is USDA doing anything to educate consumers about proper handling?

EWING

We like to think USDA is trying. They have some educational information on their website. But I don't know how effectively they get it out to consumers. I don't know of any social media efforts on the agency's part toward this end. In general, I don't think USDA has been effective educating consumers and consumer groups.





SLEEPLESS NIGHTS



KECK

Let's conclude by reviewing your greatest concerns regarding food safety and the poultry industry. Put another way: What keeps each of you up at night?

SMITH

To me, it's the liability we all operate under every day. I don't see how our CEOs sleep at night. If left unchecked, any one of these organisms could destroy a poultry company.

SINGER

I've been working in the field of food safety and antibiotic resistance for about 20 years. What keeps me up at night is the presumption that these risk models and performance standards developed by FSIS actually predict anything related to public health. In all my work, I don't see how any of these approaches can actually predict risk. In the end, it's up to the companies to do it themselves, because the assumptions of these risk models are highly flawed.

CALHOUN

I've spent most of my career involved hands-on with two large processing companies. What really does keep me up at night is not knowing what USDA's going to send down the pike to us next. What new standards will the industry have to deal with? And will they be based on sound science or image?

HOFACRE

What keeps me up at night is my involvement in food safety and, recently, foodborne outbreaks at commercial companies. Being deposed by a group of lawyers for 8 or 9 hours, having federal marshals come to my office and copy records, then being deposed at grand jury hearings.

EWING

I agree that one outbreak is one too many, but I am concerned about all the scrutiny on certain segments of our industry. There are many sources for *Salmonella* other than chicken, such as fruits, vegetables, even flour. I feel the epidemiology is not well-planned or thought out. In other

“ What really does keep me up at night is not knowing what USDA's going to send down the pike to us next. ”

SHANE CALHOUN



“ *Salmonella, Listeria, E. coli* — all those organisms are just waiting for a break in our defenses and people can get sick. ”

DOUGLAS FULNECHEK, DVM

words, you can have a break, and because a *Salmonella* looks like a strain that had been isolated at a certain plant, even years ago, it could incriminate a facility. I'm worried about [poultry companies] being falsely accused while the true source of the outbreak is not identified.

WILLINGHAM

Marketing — the non-scientific aspects of poultry that can counter things we can't justify scientifically — keep me up at night. It bothers me greatly. Unfortunately, this type of marketing can come from inside or outside of this industry. I'm referring to the "negative labelling" trend of products with obscure, meaningless claims that imply value to the consumer. The main one has been labeling about steroids and hormones that mislead consumers. We can go on about these claims forever. There are also various antibiotic claims that mislead the consumer. FDA dropped the ball by allowing the implication that meat, poultry or food products have levels of antibiotics or pesticides. All the work FDA did to verify that minimum residue limits

are met and that food products are safe was thrown away by negative labeling that implies some products are loaded with antibiotics and pesticides. Simply, could someone show me where the non-natural food is raised on non-farms?

FULNECHEK

What concerns and upsets me is that if we don't all do our job, somebody could die. *Salmonella, Listeria, E. coli* — all those organisms are just waiting for a break in our defenses and people can get sick.

O'CONNOR

One thing I learned from an outbreak we had is that your brand can really suffer in today's world of Internet and social media, which leads to "public shaming." We were working our tails off during the outbreak to resolve it — that's not an exaggeration. There were many a sleepless night. The criticisms from the media and Internet did not account for that work. It's something I would not want to repeat; that's what still keeps me up at night.

¹ Russell SM. The Effect of Airsacculitis on Bird Weights, Uniformity, Fecal Contamination, Processing Errors, and Populations of *Campylobacter* spp. and *Escherichia coli*. *Poult Sci*. 2003;82:1326-1331.

