Shayla Bailey:	Hello and good afternoon, everyone and welcome to USDA's Salmonella in Poultry: Research and Science Roundtable. My name is Shayla Bailey and I'm joined today by Dr. Isabel Walls. We're going to be your moderators for today's event. You can go ahead to the next slide.
	Before we get started with our formal agenda, I want to go over a couple of logistics. We will have three presentation sessions with brief breaks in between and each session will be followed by two discussion periods. One for questions from a panel of FSIS experts and one for audience questions and comments. Next slide.
	During the discussions, we'll take questions via the chat panel found at the bottom of your WebEx window and we'll also take questions verbally. If you use the chat, please make sure that "all panelists" is selected from the dropdown list to make sure we don't miss your questions or comments. I'll provide some additional instructions for verbal questions once we reach our first discussion period. And if you need assistance at any time during the event, please don't hesitate to send a chat to me or our event producer. Next slide.
	And now I'd like to introduce Sandra Eskin, Deputy Under Secretary for Food Safety, who will get us started with some welcoming remarks.
Sandra Eskin:	Thank you, Shayla. Good afternoon or good morning, depending on your time zone. I want to thank you all and welcome you for coming for this round table discussion. In October of last year, the Office of Food Safety and FSIS launched an effort to reevaluate and reshape our approach to how we control salmonella in poultry. Our goal is to identify changes in our strategy that we believe will lead to a reduction in the number of salmonella illnesses due to consumption of poultry. We've already had many conversations with stakeholders at round tables, at conferences and at meetings with smaller groups and coalitions in which they've shared their ideas and their thoughts. We've also asked for recommendations from the National Advisory Committee on my microbiological criteria for food to help guide our strategy. And we've solicited ideas for pilot projects to test drive different control strategy and produce data on how they work.
	Of course, we need to ensure that whatever strategy we adopt is grounded in science and that brings us to the purpose of today's round table. Today, we will ask experts what the science tells us about a range of issues related to salmonella control in poultry. We expect to learn about salmonella surveillance and monitoring of stereotypes, quantification and biomapping and pre-harvest and processing practices that impact salmonella contamination. We are very grateful to our six presenters today who joined us to share their research and knowledge. There'll be dedicated time, as Shayla mentioned, for questions and discussion throughout the afternoon. We're looking forward to an interactive exchange. During each discussion section we'll lead off with questions from the FSIS senior leaders and scientists who are involved in shaping our new

approach. We're looking forward to using this time to explore many of the questions that we've been asking internally while considering various approaches.

We've also asked Dr. Rob Tauxe from the Centers of Disease Control and Prevention to join these discussions as an expert on the public health impacts of foodborne illness and he is one of the participants in the panels. Again, there'll be time for questions from the audience during each discussion section and we'll be recording but only the presentations and we'll post them afterwards. I want to emphasize that discussion sessions will not be recorded.

Finally, since I have your attention, I want to take this opportunity to announce that FSIS intends to enter into a cooperative agreement to conduct a risk assessment for salmonella. We will soon be requesting proposals for multidisciplinary teams with access to industry data and expertise in dose response modeling to collaborate on this risk assessment. Thank you again to all our presenters and thank you for participating in this meeting today. I will turn it over now to Dr. Isabel Walls to get us started with the first presentation.

Isabel Walls: Thank you very much, Sandra. And we're going to have a really exciting meeting this afternoon. I'm really looking forward to it. We're going to start off with our first speaker who is Dr. Craig Hedberg. Now you all should have received biographical sketches for all our speakers so I'm not going to go into too much detail here, but essentially Dr. Hedberg is an epidemiologist and professor in the division of environmental health sciences at the University of Minnesota School of Public Health. Please go ahead, Dr. Hedberg.

Craig Hedberg: Thank you very much.

Thank you very much. It's a great honor to be part of this presentation and I really appreciate the opportunity to speak on this problem. In discussing surveillance and risk assessment I'm not really going to focus on the overall epi trends in *Salmonella* that Dr. Patty Griffin and colleagues at CDC have so thoroughly reviewed in recent meetings. Instead, I want to focus on some key principles and application of surveillance and risk assessment that are related to both the virulence of serotypes and levels of contamination of products. And then look at an example of a current problem that highlights these principles and their application. If I could have the next slide, please.

This is a figure which depicts a cycle of public health prevention. It's one I proudly have adapted from Rob Tauxe at CDC. And it really highlights the importance of public health surveillance to providing a framework for prevention. And it really starts with the premise that humans are the ultimate bioassay for the food supply. And because we are consuming what is in the food products that are out there, surveillance is always going to be one important measure of the impact of that contamination.

And through surveillance, we identify potential outbreaks that lead to epidemiological laboratory and environmental investigations that may identify the source of contamination and may lead to additional studies that identify a root cause that then can inform prevention measures and provide feedback on the effectiveness of our food safety systems, for which our continued surveillance helps us better understand. It also is really the key to identifying new hazards in our food supply, which is a stimulus to applied research and again, the development of prevention measures. And CDC has really been a great promoter and bulwark in this approach and given the rest of the food safety system, many of the tools needed to be able to develop these prevention measures. Next slide, please.

But as this slide notes, interventions should lead to better control. This slide represents some data from the state of New York and New York City and it looks at the successful intervention made by the New York City Health Department in posting letter grades from restaurant inspections in 2010. And we can see on the right-hand side of this slide, from 2010 to 2015, the implementation of this control measure really led to about a 5% decline in the incidence of *Salmonella* infections in New York City, relative to the rest of New York State. Also interesting about this slide on the left-hand side, you can see marked declines in *Salmonella* from 1995 through about 2000 or so. And this actually reflects better control of *Salmonella* enteritidis that was occurring in egg sources during this timeframe. Next slide please.

And another validation that surveillance can improve prevention are these figures that were taken from an evaluation of PulseNet. There seems to be some comment that the slides are not advancing for the audience. On the left-hand side, are outbreaks of *Salmonella*. In blue, the top adapters of PFGE in the framework of PulseNet and the orange being the middle adapters and then the green being the states that were the slowest adapters of PulseNet. And what we can see on the right-hand side is that among the states that were the highest adapters of PulseNet and PFGE subtyping for *Salmonella*, there actually was a decline in the incidence of *Salmonella*. Again, suggesting that better surveillance was leading to control measures that were being implemented by industry, therefore reducing exposure to *Salmonella*. Next slide, please.

This really leads us to a discussion of the risk assessment methodologies and a paper that was part of a PhD thesis for Rolando Gonzalez, who was looking at chicken meat processing interventions and made the comment that quantitative microbial risk assessment studies on *Salmonella* have reflected that the most impactful input parameter on reducing the number of illnesses is the ingested dose, that is ultimately related to the final pathogen concentration. And relevant to our discussion today, that future research studies focused on collecting data about the impact of current and novel food safety interventions on salmonella levels under real or closely simulated processing conditions would greatly improve the accuracy of the prediction by simulation models. And that quantification of *Salmonella* in poultry products is really one of the great needs

that we have for improving our understanding of the public health risks at this time. Next slide please.

And this is a framework for a study that Fernando Sampedro and some colleagues of mine worked on regarding *Salmonella* in ground turkey, trying to relate the levels of contamination based on enumeration studies conducted by FSIS, with the number of cases that may have been occurring in the population and then the impact of interventions aimed at reducing high level of contamination in these products. This paper was published in Epidemiology and Infection several years ago and we recently have revisited this with some updated inputs reflecting *Salmonella* prevalence and the proportion of highly virulent subtypes in products that are sampled by FSIS. Next slide, please.

The results of the risk assessment modeling really demonstrated the importance of *Salmonella* concentration in the product at the time that the consumers obtained it. It was the second most important contributor to the variability seen, second only to cooking temperatures of chicken in the home environment. Next slide, please.

And this slide shows some of our updated outputs of that. A baseline estimate mean value of 23,000 illnesses associated with consumption of ground turkey in the United States and the impact of two different interventions. One, the impact of removing the high virulent subtypes serotypes, which reduced illnesses by about 97% to 3,228 and then removing products contaminated at more than one MPN of *Salmonella* per gram, which reduced illnesses by 94% and removing contaminated lots with levels more than one MPN per 25 grams, which resulted in a 99.7% reduction in illnesses. But one of the things we did in this model also was to look at the impact of levels of contamination in individual 2,000 pound lots of product. And that's important to us because it's those individual lots which may coincide with some of the products that get into the marketplace that are driving illness.

And on the right hand side, we can see the X axis being log MPN per gram and then there are gray bars and then dark black bars that only begin appearing at the higher level. The gray bars represent estimated numbers of illnesses in individual 2,000 pound lots. The black bars would be based on those number of illnesses, how many would likely be reported through our public health surveillance to health departments. And then the percent being the likelihood that we would be able to detect an outbreak and link it to that product source. And you can see that it really is at the higher levels of contamination that we really begin to have the power to detect outbreaks associated with these because of the common exposures that are occurring. Next slide, please.

That brings us to what I really want to propose is an example that is bringing a lot of these points together and that is illnesses that have been associated with these frozen raw breaded stuffed chicken products. These are probably not accounting for a very high proportion of *Salmonella* illnesses in the population

but I think the occurrence of these outbreaks highlight some of what we're trying to look at today. This first table is outbreaks that were detected in Minnesota and the Minnesota Department of Health has been in involved in most of the outbreaks of these products in the United States.

But the first outbreak detected really was in 1998, 1999, outbreak of *Salmonella* typhimurium. Minnesota started doing routine PFGE testing of *Salmonell*as in the mid-1990s and routinely interviewing all cases. This detection in 1998, 1999 represents about the earliest that we could have detected an outbreak caused by these types of products. Before that, we really didn't have a lot of tools to distinguish one Typhimurium from the other. And you can see that the serotypes, Typhimurium, Heidelberg, Enteritidis, represent some of our more virulent serotype pathogens. And so these are really not just a sampling of what is in chicken but really a sampling of the strains of concern that cause illness in people. Next slide, please.

This is a slide that really depicts the method for looking at estimating cases of illness that have been associated with recalls that was developed by Scott Seys who completed a PhD with us while he was working for FSIS as an epidemiologist in their public health office. And it demonstrates a model that may be useful for us to look at public health impact and our ability to prevent illnesses, even in the context of an outbreak. And in work that was done by Scott, he states that were reported more outbreaks were more likely to be part of an illness associated recalls. Suggesting that the states that were more efficient at surveillance were picking up more of these events earlier. Next slide, please.

And this slide shows sort of a more recent series of events. These are four outbreaks of *Salmonella* associated with these frozen raw breaded chicken products from 2014 through 2021. And this sort of straddles the change in public health surveillance from PFGE to whole genome sequencing. And you can see these are all four outbreaks associated with *Salmonella* enteritidis, which has emerged as an important contaminant of raw broiler meats. And you can see that the most recent event in 2021 was the biggest event and involved the most cases in states other than Minnesota. And our estimates are that of all four recalls, the one in 2021 was associated with 44 cases that were prevented. Next slide, please.

And in this slide, we can look at the 44 cases being prevented by the recall on August 9th, which would've been 56% of potential cases. You can see that after the recall, within about a week, there were no new illnesses associated with this product but there might have been two earlier time periods when recalls could have been considered that would've led to additional cases being prevented as well. But because product contamination was not directly linked to individual cases, it wasn't viewed as being strong enough to lead to the occurrence of a recall. And I think this is a policy that could well be reevaluated as well. Next slide, please.

This is my last slide. Just to summarize some of the lessons that were learned from outbreaks associated with these frozen raw breaded chicken products and why I think they give us a model that we can use to think about the bigger problem associated with chicken. These outbreaks have been associated with serovars of concern, rather than the full range of *Salmonella* detected in the products. The outbreak durations persist over months, even when associated with one or two days production. The routine use of whole genome sequencing for human illness will improve detection of outbreaks and give more accurate picture of the size and geographic spread of the outbreak. And importantly, the episodic nature of these outbreaks suggests that contamination of specific lots with high levels of serovars of concern cause outbreaks associated with products that are frequently mishandled. And this is where I think these products form a nice model for the general concern over chicken. And I'll end it there.

Isabel Walls: Thank you so very much, Dr. Hedberg.