SALMONELLA MONTEVIDEO, RESTAURANT RECIDIVIST

Mackenzie Tewell
Foodborne Epidemiologist
Arizona Department of Health Services
January 16, 2019
In May of 2018, our lab notified us of an uptick of PFGE matched cases of Salmonella Montevideo pattern 0126.
I once heard someone on a conference call refer to themselves as a “SEDRIC Power User” and I have since adopted this title for myself, so naturally I decided to take a looksee in my favorite database and discovered that this wasn’t a terribly uncommon pattern in Arizona. Historically, 125 of 188, or 65% of pattern 0126 isolates were from Arizona.
All of the 125 isolates were from Maricopa County, the most populous county in Arizona where Phoenix is located.
And I take a look to see how often we see this pattern in Arizona. Now I’m no expert, but I think you and I both can tell that something happened in 2008 and that the rest of the years around it we just don’t see that many cases of this PFGE pattern, even going 4 of the past 7 years without any cases at all.
In turns out that in 2008 there was a large outbreak with this pattern associated with multiple locations of a restaurant chain in Maricopa County.
During this outbreak there were 58 cases that reported eating at a restaurant we’ll call The Funky Fowl.
Though there are about 19 locations of this chain in Maricopa County
There were three that had two or more cases mention consuming food there, and these locations became the main focus of the investigation.
We assume that raw chicken introduced the Salmonella into the restaurant.
And over multiple environmental samplings, the outbreak strain was isolated from cilantro at location A, twice at location B, from chicken marinade twice and a cutting board once at location B.
And we can’t leave out all the other types of Salmonella that were isolated from chicken at all three locations.
So obviously I’m *dying* for a 10 year anniversary outbreak with all the cases linked back to one of these Funky Fowl locations, however, there were no recent cases mentioning eating at these restaurants.
But I had a feeling deep in my belly that this was related, and for the sake of this presentation I’ll let you know that I was right and that it was indeed related to the 2008 outbreak with the same pattern. To appease this feeling, I requested that counties call back the cases we had talked to already, and ask about The Funky Fowl during future interviews.
Soon we discovered that cases WERE eating at The Funky Fowl and they were all at location B, which if you’ll recall, was the location in 2008 with the most environmental isolates that matched the outbreak strain. With this, we were in contact with Maricopa County Environmental Services who inspected facility and found numerous opportunities for cross contamination including a cook who would occasionally throw around raw chicken. They took 24 samples—18 environmental swabs and 6 food samples and I don’t think you’ll be shocked to hear we got some positive results.
Positive samples include tongs, the backsplash, the cutting board, a freeze door handle, a plastic air curtain, the order screen in the kitchen and a component of their lettuce chopper.
All samples BUT the lettuce chopping component tested positive for the outbreak strain.
The lettuce chopper component was Salmonella Give, and fell of the radar as we only had this one positive and there were no human cases of Salmonella Give that may be related.
MCES went back to reswab the 7 items that were positive and found that 3 items were positive again, the backsplash, cutting board and tongs, again matching the outbreak strain.
In response to repeated positive samples, TFF was closed for a week for cleaning, food handler and active managerial control trainings and replacement of worn equipment, including the cutting board. They reopened once the cutting board, tongs and backsplash all tested negative for Salmonella, and there were no additional cases seen after the restaurant closing.
Obviously we were anxious to see what WGS had to say about how our cases may be related, especially because we had some denying eating at The Funky Fowl and one case who reported eating at a different location.
We asked for assistance from the state of Colorado lab. That is actually a state not just a rectangle like you thought.
And we were thrilled to hear that all isolates were related, both environmental and human, even the case who ate at a different location, though we don’t’ have a great explanation for that.

While we had been measuring this outbreak from the start of May 1, 2018, we found that some isolates dating back to September 2018 were matching, indicating that this had been hanging around the restaurant for more than a few months but there weren’t enough cases to grab our attention.

So we were then very intrigued and wanted to continue to request isolates for analyzing, but none of the isolates from prior to 2017 were around to be sequenced. However, on a whim, we decided to double check with our lab to see if by ANY chance, they had old environmental or food isolates from the 2008 outbreak that could be sequenced.
This prince on a white horse is Roumen Penev, one of our environmental laboratorians, and he’s the real hero in this tale. Perhaps he’s a packrat or because the food testing lab has a large freezer, it turns out that he actually had an isolate from the 2008 outbreak in the freezer that he grew up and we were able to sequence.

He is here at this conference so make sure you let him know how much you appreciate him and his willingness to let me use this picture in my slides.
Now, once the 2008 isolate was included, we discovered that it was an average of 30 SNPs from the 2018 isolates.

There are two ways we could interpret this finding. One is that this isolate is completely unrelated and random and it should not be included in the investigation. Or, it could indicate that the resurgence of Salmonella Montevideo in this Funky Fowl location is due to persistent environmental contamination. That this strain of Salmonella has been hanging out in the restaurant for 10 years and somehow got loose and caused more cases.
In addition to conducting our WGS analysis, Joel Sevinsky and Logan Fink, the laboratorians in Colorado tell us they recently analyzed WGS for another outbreak of Salmonella Montevideo that occurred over a long period of time that they felt might help us make sense of the our outbreak.
It turns out that Orange County, CA had a outbreaks of Salmonella Montevideo in a restaurant that persisted over 15 years. They had three “flare ups” of the same 4 PFGE patterns in the same restaurant in 1997, 2000 and 2012.

Of note, the PFGE patterns for the CA outbreak are NOT closely related to the Arizona outbreak PFGE.
Joel and Logan in CO conducted their WGS analysis and found a strikingly similar pattern between the two outbreaks.
You’ll see that there are three distinct clades, one in 2000 and two from 2012.

Like our lucky 2008 isolate found by Roumen, they had one isolate from the 1997 outbreak that they used to compare against these distinct clades over time.
And amazingly, what they found was the 1997 isolate was an average of 27 SNPs from the 2000 isolates, and 60 SNPs from the 2012 isolates.
Are you excited yet??

To recap, Arizona had recurrent outbreaks of Salmonella Montevideo in 2008 and 2018 and that there is roughly a 30 SNP difference between this 10 year time period.
And Orange County, CA had three recurrent outbreaks of Salmonella Montevideo over a 15 year period, and they, too, found an average of 30 SNP differences between each outbreak.
Super nerdy and cool.

If you don’t think this is awesome, you’re wrong.
So my curiosity was overwhelming—what restaurant was this happening in at the Orange County restaurant? I emailed CA and quickly got ahold of an epidemiologist who is still around in Orange County and he was reluctant to tell me which restaurant this was. So I threw out there that ours was at The Funky Fowl.
And if you’re thinking SURELY this can’t be the same restaurant, it sure was! The same restaurant, same serotype of Salmonella, same repeated outbreak, just different PFGE patterns.
So California and Arizona got together to talk about it over a shared chicken dinner.
Over the next couple of months over after the outbreak ended, there were a number of conversations that were had between The Funky Fowl Corporate Quality Assurance who was incredibly responsive and willing to accept any suggestions that were made from the health department to prevent this from happening in the future. CA, AZ, CDC and the county health departments involved about these outbreaks where we shared the commonalities and differences and discussed next steps for ongoing surveillance and what would happen if additional cases were seen.
Let’s discuss.
We know that it’s not shocking that we’d find Salmonella in a restaurant that serves a lot of chicken.
But what made these restaurants more susceptible to persistent outbreaks? Was there something about their kitchen set up? Their practices?

We know that they’ve made adjustments to their marination processes, including how frequently they do it, how they store the products and how they clean their equipment. They have shown great willingness to make changes and replace equipment as recommended by health departments.

Another complicating factor is that some of these restaurant locations are corporate owned and some are franchise owned, so they are not all following the same regulations and procedures set out for ensuring food safety.
Obviously there are some biofilm issues happening in both of these restaurant locations. They were so extensive in the Orange County location that they ended up gutting the entire restaurant in 2012 to remedy the issue.

There were not such drastic measures taken at the Maricopa County location, so you better believe I’m always watching out for more cases.
Is there something special about *Salmonella* Montevideo?

But what we don’t know is if there is any significance, if at all, about the pathogen itself that could indicate it is more likely to stick in biofilm and be persistent in the environment. This is an intriguing topic and one we are hoping to learn more about.
Unlike the California outbreaks, Arizona decided against testing food handlers. This isn’t a common practice in Arizona counties. I imagine if the outbreak had continued after the restaurant was closed and cleaned, it may have been more likely
Another area of discussion was sampling of non-food contact surfaces. Orange County found the outbreak strain in a number of surprising places, including hinges that hold the cutting board in place, the floor, grease pans near the floor, inside a container that held utensils and even the soil outside the kitchen where mop water was dumped.

While Arizona found the outbreak strain on non-food contact surfaces like the backsplash and order screen in the kitchen, there was no additional testing done on locations such as the floor, floor drains or other crevices that can be sources of ongoing contamination.

Orange County also followed up with frequent environmental sampling after the kitchen had been remodeled in 2012 to ensure the bacteria wasn’t still hanging out, but this measure was not adopted in Arizona.
Finally, we can’t help but wonder what’s happening at The Funky Fowl that is different than other chicken specific restaurants. Perhaps these outbreaks are happening and we don’t know it? I’d love to know!
I’m happy to answer any questions, and would like to take a minute to thank folks in Colorado and California for their assistance and willingness to share information with us!