Foodborne Disease Outbreak Response
A State-Level Perspective on Collaborating with Federal Partner Agencies

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Epidemiologist Principal
Foodborne Diseases Unit

Minnesota Department of Health
From Farm to Table, and Beyond

Food Safety Continuum

Epidemiologists-Public Health

Post-Foodborne illness
Role of Epidemiology in Food Safety

- Identify new hazards
- Prioritize food safety interventions
- Provide feedback on effectiveness of food safety systems
Foodborne Disease Outbreaks

Outbreak investigations are disproportionately important:

- Specific sources can be identified
  - New vehicles can be recognized
  - Risky production practices can be identified
- New pathogens can be recognized
- Media interest provides opportunities for public health communication
Outbreak Detection and Investigation Tools

- Surveillance systems
Two Primary Foodborne Disease Outbreak Surveillance Mechanisms in Minnesota

• Complaints
  – Foodborne illness complaint hotline (public)

• Reportable disease surveillance
  – Individual reported cases are interviewed, exposures compared to other reported cases
Two Primary Foodborne Disease Outbreak Surveillance Mechanisms in Minnesota

• Complaints
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Complaints

- Types of outbreaks detected: Restaurants, events
- 79% detected solely from consumer complaints
- 8% of outbreaks detected through combination of complaints and other surveillance methods
Confirmed Foodborne Outbreaks by Etiology, Minnesota, 1999-2014 (n=812)

- Bacterial intoxications: 10%
- Salmonella: 14%
- E. coli O157:H7: 14%
- Other/unknown: 5%

CATEGORY NAME: 57%
Two Primary Foodborne Disease Outbreak Surveillance Mechanisms in Minnesota

• Complaints
  – Foodborne illness complaint hotline (public)

• Reportable disease surveillance
  – Individual reported cases are interviewed, exposures compared to other reported cases
FOODBORNE AND WATERBORNE DISEASES

Botulism (Clostridium botulinum)

Campylobacteriosis (Campylobacter sp.)*

Cholera (Vibrio cholerae)*

Cryptosporidiosis (Cryptosporidium parvum)

Enteric Escherichia coli infection (E. coli O157:H7 and other pathogenic E. coli from gastrointestinal infections)*

Giardiasis (Giardia lamblia)

Hemolytic uremic syndrome

Listeriosis (Listeria monocytogenes)*

Salmonellosis, including typhoid (Salmonella sp.)*

Shigellosis (Shigella sp.)*

Toxoplasmosis

Yersiniosis (Yersinia sp.)*

* Submit clinical materials to the Minnesota Department of Health
Representativeness of Reported Cases

Salmonellosis: 1

Est. 29.3
Outbreak Detection and Investigation Tools

• Surveillance systems
  – Complaints
  – Reportable diseases
• Laboratory data
  – Characterization: Serotyping, PFGE, WGS, other
Pulsed-Field Gel Electrophoresis (PFGE)

- DNA fragments are separated in the gel based on size
- Pattern of fragments is DNA fingerprint
- A cluster is 2 matching DNA fingerprints
- National database: PulseNet, CDC
SNP analysis (‘Single Nucleotide Polymorphisms’): Determined (‘called’) against a well characterized (‘reference’) sequence of a single closely related strain

Here, there is a one-nucleotide difference between the reference genome and the reads in the query genome

Peter Gerner-Smidt, MD, ScD, CDC
In vivo, same as E2001001070

MDH00215 - Sporadic 4/19/01
MDH00214 - Sporadic 3/12/01
MDH00207 - Sporadic 4/30/2001
MDH00201 - Sporadic 7/7/2000
MDH00209 - Sporadic 6/21/2001
MDH00213 - Sporadic 7/16/2001
MDH00209 - Sporadic 6/21/2001
MDH00211 - Sporadic 7/16/2000
MDH00222 - Sporadic 5/14/01
MDH00223 - Sporadic 8/6/12
MDH00224 - Sporadic 6/11/2001
MDH00205 - Sporadic 8/22/2000
MDH00216 - Sporadic 4/30/2001
MDH00206 - Sporadic 8/23/00
MDH00217 - Sporadic 6/11/2001
MDH00203 - Sporadic 7/11/00
MDH00221 - Sporadic 5/14/01
MDH00208 - Sporadic 8/6/12
MDH00220 - Sporadic 5/7/11
MDH00226 - Sporadic 6/10/13
MDH00233 - Sporadic 12/7/2001
MDH00231 - Sporadic 10/17/01
MDH00223 - Sporadic 10/3/05
MDH00227 - Sporadic 5/14/01
MDH00228 - Sporadic 8/6/12
MDH00229 - Sporadic 10/17/01
MDH00234 - Sporadic 10/17/01
MDH00225 - Sporadic 7/16/00
MDH00226 - Sporadic 10/3/05
MDH00227 - Sporadic 10/17/01
MDH00218 - Sporadic 10/17/01

Defined Outbreak Samples

- Outbreak 1- Sept 2000
- Outbreak 2- May 2001
- Outbreak 3- Aug 2001
- Outbreak 4- Nov 2003
- Outbreak 5- Aug 2008
- Outbreak 6- Spring 2014
- Outbreak 7- Spring 2014

Outbreak Detection and Investigation Tools

• Surveillance systems
  – Complaints
  – Reportable diseases
• Laboratory data
  – Characterization: Serotyping, PFGE, WGS, other
• Interview data
Interviewing Cases: Minnesota Basic Philosophy

• Interview all cases in surveillance
• Interview ASAP
• Collect details on specific exposures
  – Dates
  – Restaurant, grocery store names
  – Brand names
  – Open-ended food histories
• Dynamic investigation approach
• For *Salmonella* or STEC O157, average 27 minutes
Interviewing Cases

• Interviewing approaches vary by state or jurisdiction
• National Hypothesis Generating Questionnaire used in multi-state clusters as needed
Outbreak Detection and Investigation Tools

- Surveillance systems
  - Complaints
  - Reportable diseases
- Laboratory data
  - Characterization: Serotyping, PFGE, WGS, other
- Interview data
- Statistical analysis
- Food testing
- Environmental health findings
- Trace-back investigations
Salmonella Outbreaks Associated with Stuffed Chicken Products, 1998-2015

- Example of epidemiology identifying problems with food
- Collaborations between state and federal agencies
- Impact on industry
Stuffed Chicken Products

Stuffed chicken products are

- Frozen
- Raw
- Breaded
- Pre-browned
- Stuffed: butter, spices and chives; ham and cheese or other ingredients
Salmonella Outbreaks Associated with Stuffed Chicken Products

• 1998-2006, four outbreaks involving product from three different manufacturers

• Most cases:
  – Thought product was precooked
  – 71% to 100% of the cases cooked the products in the microwave
  – Did not follow cooking instructions
  – Did not measured internal temperature of product after cooking
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Included stuffed chicken products as a question in MN’s routine interview form.
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**LABEL CHANGES**
March, 2006
*CONTAINS UNCOOKED POULTRY
Must be cooked thoroughly. Always cook to an internal temperature of 165°F as measured by use of a thermometer. See Cooking Instructions.
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<td>S. 4, 12:i:-</td>
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<td>P-A P-C other</td>
<td>16</td>
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**LABEL CHANGES**
March, 2006
No microwave cooking instructions
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<td>S. Enteritidis</td>
<td>SE43B72 JEGX01.0005/JEGA26.0037</td>
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<td>2015</td>
<td>S. Enteritidis</td>
<td>SE1B239 JEGX01.0004/JEGA26.0203</td>
<td>P-C P-D</td>
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**LABEL CHANGES**
March, 2006
Salmonella Outbreaks Associated with Stuffed Chicken Products

• 2008-2015, five outbreaks involving product from four different manufacturing plants
• Most cases in 2014-2015 outbreaks
  – Knew the product was raw
  – Followed cooking instructions
All *Salmonella* Enteritidis JEGX01.0004/JEGA26.0002 Isolates Received August-September 2014 (n=19)
All *Salmonella* Enteritidis JEGX01.0004/JEGA26.0002 Isolates Received August-September 2014 (n=19)
All *Salmonella* Enteritidis JEGX01.0004/JEGA26.0002 Isolates Received August-September 2014 (n=19)

- Ate chicken Kiev
- May have eaten chicken Kiev
- Secondary case
All *Salmonella* Enteritidis JEGX01.0004/JEGA26.0002 Isolates Received August-September 2014 (n=19)
Salmonella Enteritidis Cases, Brand B Stuffed Chicken Investigation by Date of Specimen Collection, April-July 2015 (n=8)

<table>
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<tr>
<th>Week of Specimen Collection</th>
<th>Number of Cases</th>
<th>JEGX01.0004/JEGA26.0203</th>
<th>JEGX01.0253/JEGA26.0203</th>
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<td>April</td>
<td>6, 13, 20, 27</td>
<td>WGS 0 SNPs</td>
<td>WGS 2 SNPs</td>
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<tr>
<td>May</td>
<td>4, 11, 18, 25</td>
<td></td>
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<tr>
<td>June</td>
<td>1, 8, 15, 22, 29</td>
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Salmonella Enteritidis Cases, Brand B Stuffed Chicken Investigation by Date of Specimen Collection, April-July 2015 (n=8)

- Ate Brand B chicken products
- JEGX01.0004/JEGA26.0203 WGS 0 SNPs
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Multistate Outbreak of Drug-Resistant *Salmonella* Enteritidis Infections Linked to Raw, Frozen, Stuffed Chicken Entrees Produced by Barber Foods (Final Update)

People infected with the outbreak strains of *Salmonella* Enteritidis, by state of residence, as of October 15, 2015 (n=15)

THE RAW STORY
Some frozen chicken entrees look like they’re cooked—but they’re not!

Handle raw frozen chicken—including frozen meals, entrees, and appetizers—the same way you handle raw fresh chicken to prevent foodborne illness:

1. Read the package carefully.
2. Follow cooking instructions exactly as written.
3. Use a food thermometer to check doneness (165°F for chicken).
4. Clean and disinfect any surfaces and utensils that touched the raw product.
5. Wash your hands with soap and water after handling the raw product.

Salmonella Outbreaks Associated with Stuffed Chicken Products 1998-2015

- Product testing conducted in all 9 outbreaks, ranging from 7 to 67 samples tested
  - *Salmonella* positive samples in all outbreaks (range, 19% to 89% positive)
  - In 8 outbreaks, multiple *Salmonella* serotypes and/or PFGE subtypes
Salmonella Outbreaks Associated with Stuffed Chicken Products 1998-2015

• Minnesota Departments of Health and Agriculture issued press releases in all 9 outbreaks
• FSIS issued consumer advisories in all but the first outbreak
• Voluntary product recalls in 5 outbreaks
  – In one outbreak product removed from store shelves but not recalled
• CDC web postings on the two most recent outbreaks
USDA Finalizes New Food Safety Measures to Reduce Salmonella and Campylobacter in Poultry

New Standards to Help Prevent an Estimated 50,000 Illnesses Annually

WASHINGTON, Feb. 4, 2016 -- The U.S. Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS) today announced the finalization of new federal standards to reduce *Salmonella* and *Campylobacter* in ground chicken and turkey products, as well as in raw chicken breasts, legs, and wings. Based on scientific risk assessments, FSIS estimates that implementation of these standards will lead to an average of 50,000 prevented illnesses annually.

As part of this move to make chicken and turkey items that Americans frequently purchase safer to eat, FSIS has also updated its microbial testing schedule at poultry facilities and will soon begin posting more information online about individual companies' food safety performance.
PROFILE UPDATE IN ESTABLISHMENTS THAT PRODUCE NOT-READY-TO-EAT STUFFED CHICKEN PRODUCTS THAT APPEAR READY-TO-EAT

I. PURPOSE

A. This notice provides instructions to inspection program personnel (IPP) at all establishments that produce raw and heat-treated but not fully cooked, not shelf stable stuffed chicken products that they are to update the Public Health Information System (PHIS) profile. This notice also instructs supervisory personnel to verify that the establishment’s PHIS profile information is accurate.

B. IPP are to update the profile so that FSIS can determine which establishments produce not-ready-to-eat (NRTE) stuffed chicken products that appear ready-to-eat (RTE). After IPP update the PHIS profiles,
Industry’s Role in Outbreak Investigations

• Industry’s collaboration during an outbreak is beneficial
  – Patron information to conduct studies to identify the source of the outbreak
  – Ingredient data or recipe
  – Ingredient or food source data
  – Food distribution data
  – Invoices and other information

• Having all the available data may help in identifying the source of an outbreak more quickly
Outbreak Detection and Investigation
Key Elements Summary

• Use multiple tools during investigations: surveillance, laboratory, interview, other data
  – PFGE a core element of outbreak detection and investigation, and adoption of WGS is expanding
• Collaboration between local, state and federal agencies essential
• Communication with industry
  – Industry participation/collaboration important to end an outbreak and/or to identify source of contamination
• Communication with the public
Thank you!

Carlota.Medus@state.mn.us