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# **Foodborne Disease Outbreak Response**

## **A State-Level Perspective on Collaborating with Federal Partner Agencies**

**Carlota Medus, PhD, MPH**  
**Epidemiologist Principal**  
**Foodborne Diseases Unit**



# From Farm to Table, and Beyond



# **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**
  - **Foodborne illness complaint hotline (public)**
- **Reportable disease surveillance**
  - **Individual reported cases are interviewed, exposures compared to other reported cases**



## Complaints

### Minnesota Foodborne Illness Hotline

Call to report  
foodborne illness

Toll free statewide:

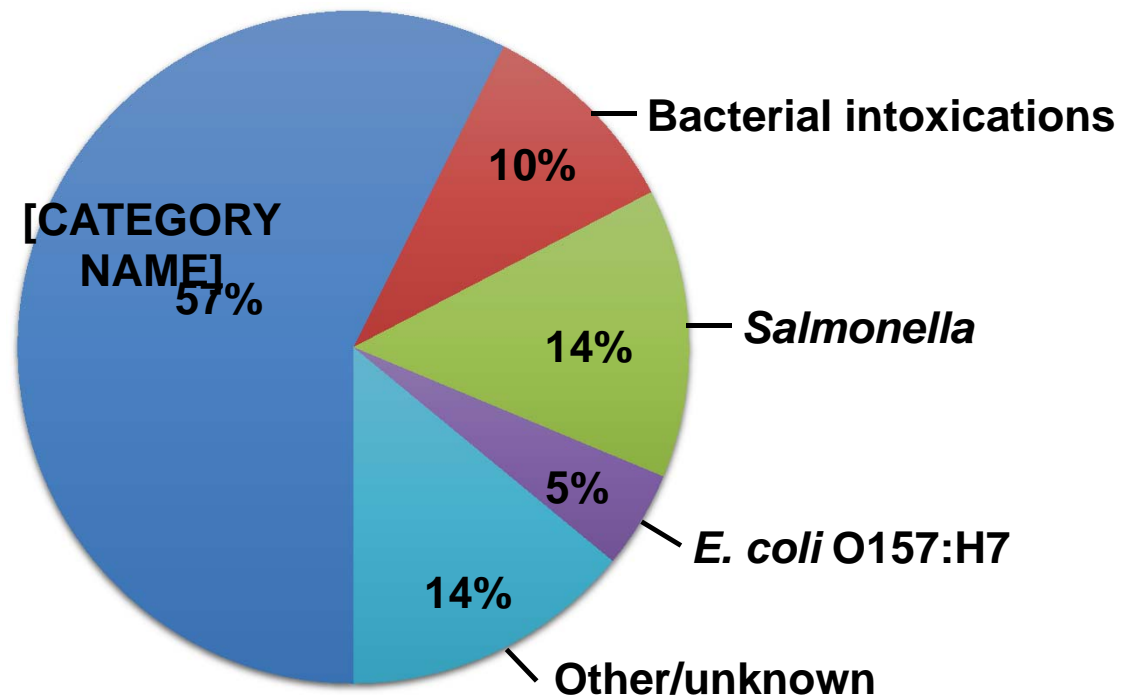
1- 877- 366-3455

1- 877- FOOD ILL



- 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)



# 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



## Diseases Reportable to the Minnesota Department of Health

### 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.)\***

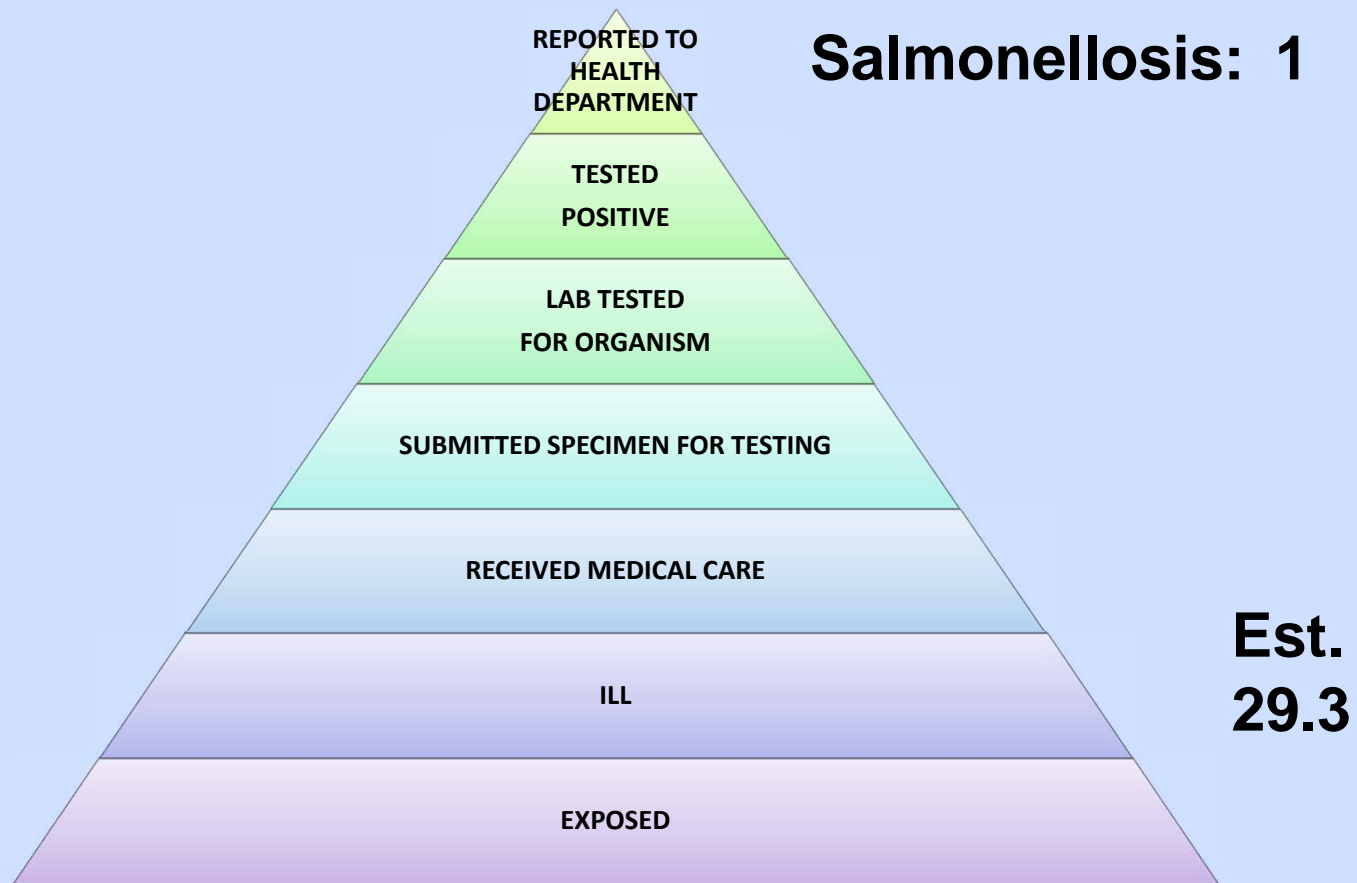
**Shigellosis (*Shigella* sp.)\***

**Toxoplasmosis**

**Yersiniosis (*Yersinia* sp.)\***

\* Submit clinical materials to the Minnesota Department of Health

# Representativeness of Reported Cases

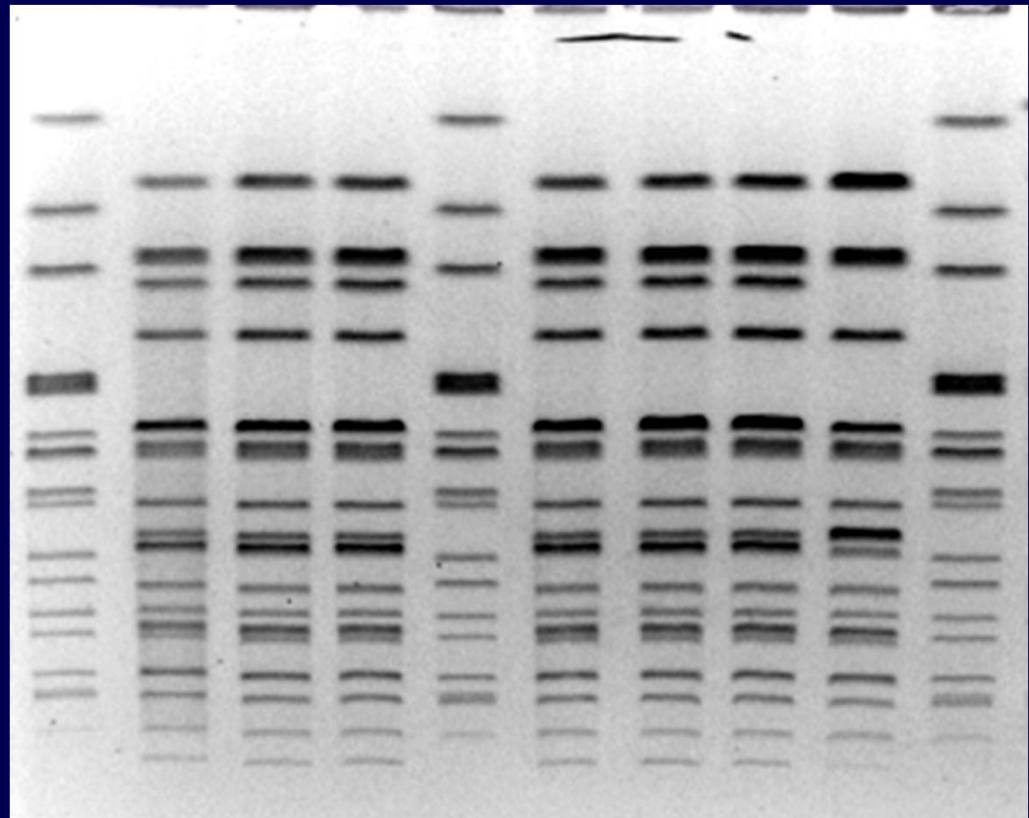


# Outbreak Detection and Investigation Tools

- **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



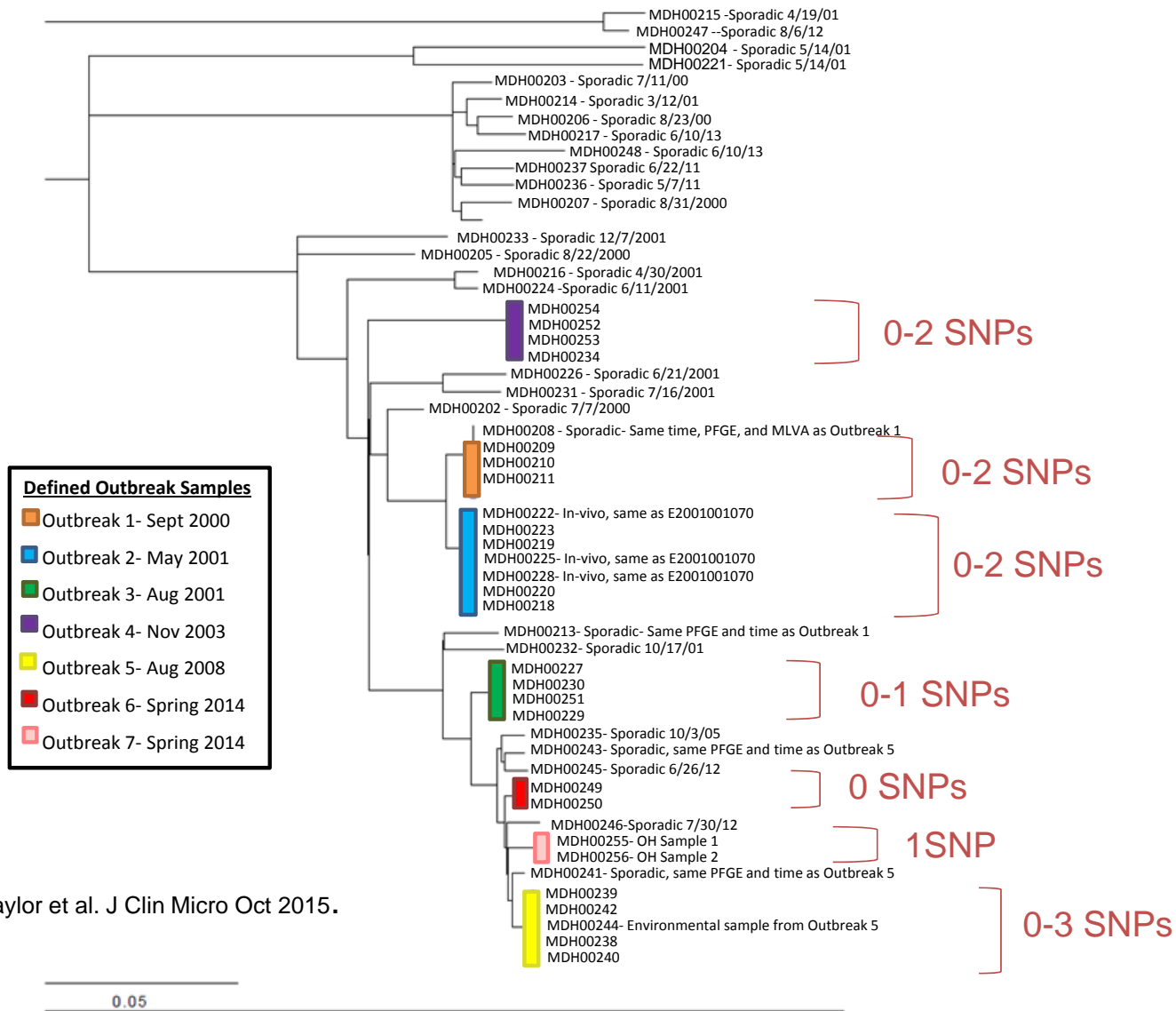
# Whole Genome Sequencing (WGS)

**SNP analysis ('Single Nucleotide Polymorphisms'):  
Determined ('called') against a well characterized  
( 'reference' ) sequence of a single closely related strain**

CCCGGCCCTTTGGCCCTTTGGGAAATCGCCCCAATGGAAATTT	<u>Reference</u>
CCCTTTGGCCCTATGGGAAATCGCCCCAATGGAAATTT	read 1
CGGCCCTTTGGCCCTATGGGAAATCGCCCCAATGGAAATTT	read 2
CCCGGCCCTTTGGCCCTATGGGAAATCGCCCC	read 3
CCTATGGGAAATCGCCCCAATGGAAATTT	read 4
GCCCTTTGGCCCTATGGGAAATCGCCCCAATGGAAA	read 5
CCGGCCCTTTGGCCCTATGGGAAATCGCCCCAATGGAAAT	read 6
CCCGGCCCTTTGGCCCTATGGGAAATCGCCCCAATGG	read 7
CCCGGCCCTTTGGCCCTATGGGAAATCGCCCCAATGGAAATT	read 8
CCCGGCCCTTTGGCCCTATGGGAAATCGCCCCAATGGA	read 9
CCCGGCCCTTTGGCCCTATGG	read 10
*	

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





Taylor et al. J Clin Micro Oct 2015.

# Outbreak Detection and Investigation Tools

- **Surveillance systems**
  - **Complaints**
  - **Reportable diseases**
- **Laboratory data**
  - **Characterization: Serotyping, PFGE, WGS, other**
- **Interview data**

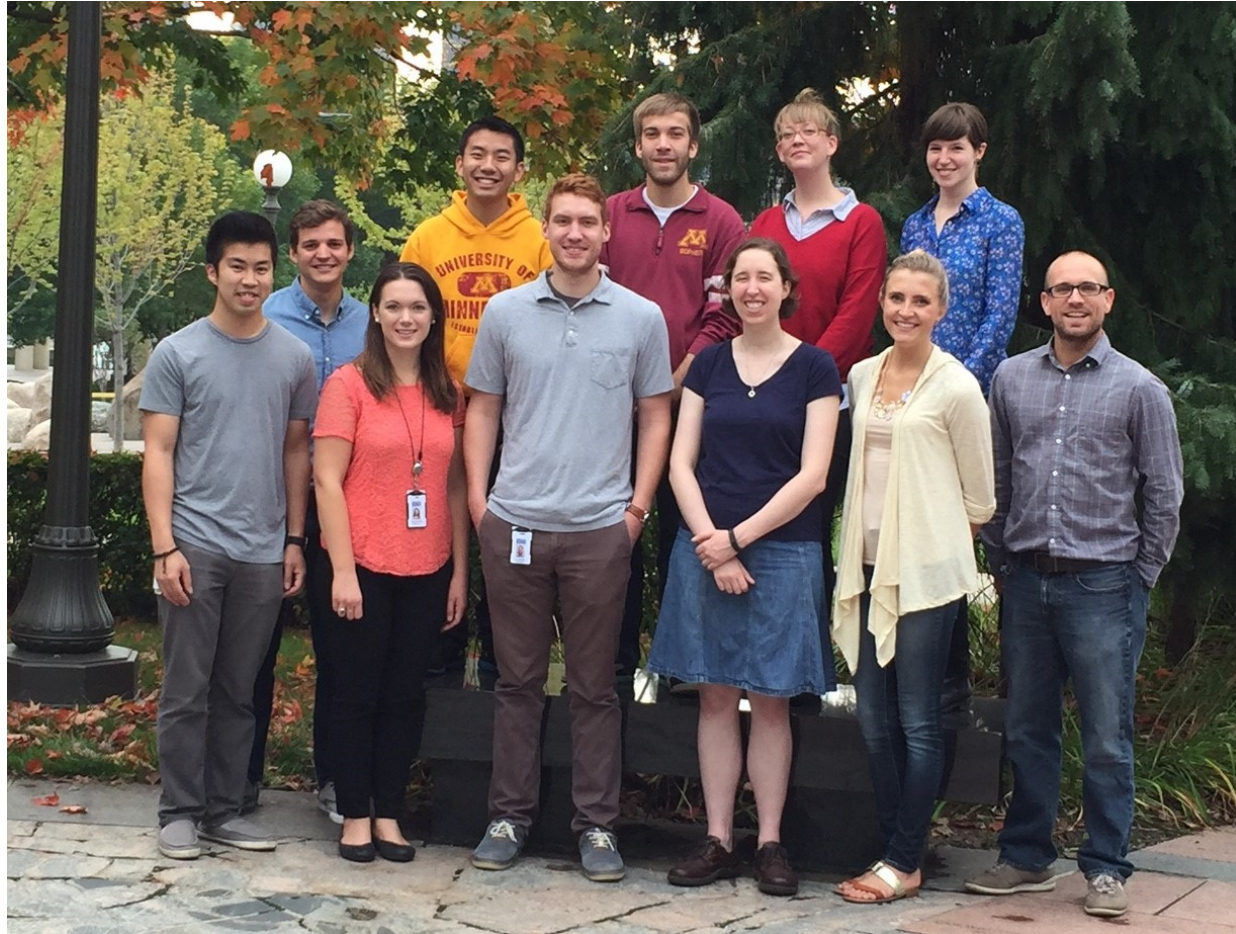
# Interviewing Cases: Minnesota Basic Philosophy

- 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**

# Team Diarrhea



# **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**



Year	Pathogen	PFGE	Plant number	Number of cases
1998	S. Typhimurium	TM123	P-A	33
2005	S. Heidelberg	SH60 JF6X01.0117	P-B	4 (matches in MI)
2005-2006	S. Enteritidis	SE43 JEGX01.0005	P-B P-A P-C	27 (+14 additional cases in CA, CO, IA, IL, MD, ND, OK, PA, TN)
2006	S. Typhimurium	TM2C JPXX01.0001 and .1212	P-B	3

Included stuffed chicken products as a question in MN's routine interview form

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**LABEL CHANGES**  
**March, 2006**



**Microwave cooking instructions removed**

Year	Pathogen	PFGE	Plant number	Number of cases
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2006	S. Typhimurium	TM2C JPXX01.0001 and .1212	P-B	3
2008	S. Enteritidis	SE43B18 JEGX01.0005/JEGA26.0004	P-A	7
2008	S. 4, 12:i:-	TM932TMB44 JPXX01.0642/JPXA26.0331	P-A P-C other	16

**LABEL CHANGES  
March, 2006**



No microwave cooking instructions

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2008	S. 4, 12:i:-	TM932TMB44 JPXX01.0642/JPXA26.0331	P-A P-C other	16
2014	S. Enteritidis	SE1B1 JEGX01.0004/JEGA26.0002	P-B	8
2015	S. Enteritidis	SE43B72 JEGX01.0005/JEGA26.0037	P-B	5
2015	S. Enteritidis	SE1B239 JEGX01.0004/JEGA26.0203	P-C P-D	15 (MN, IL, CT, NH, NY, OK, WI)

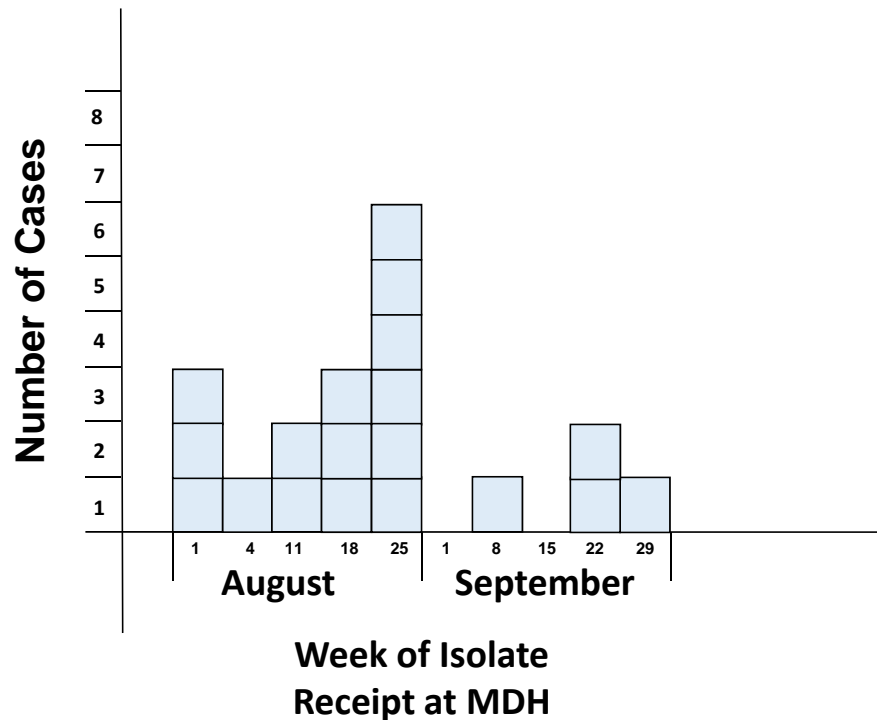
**LABEL CHANGES  
March, 2006**



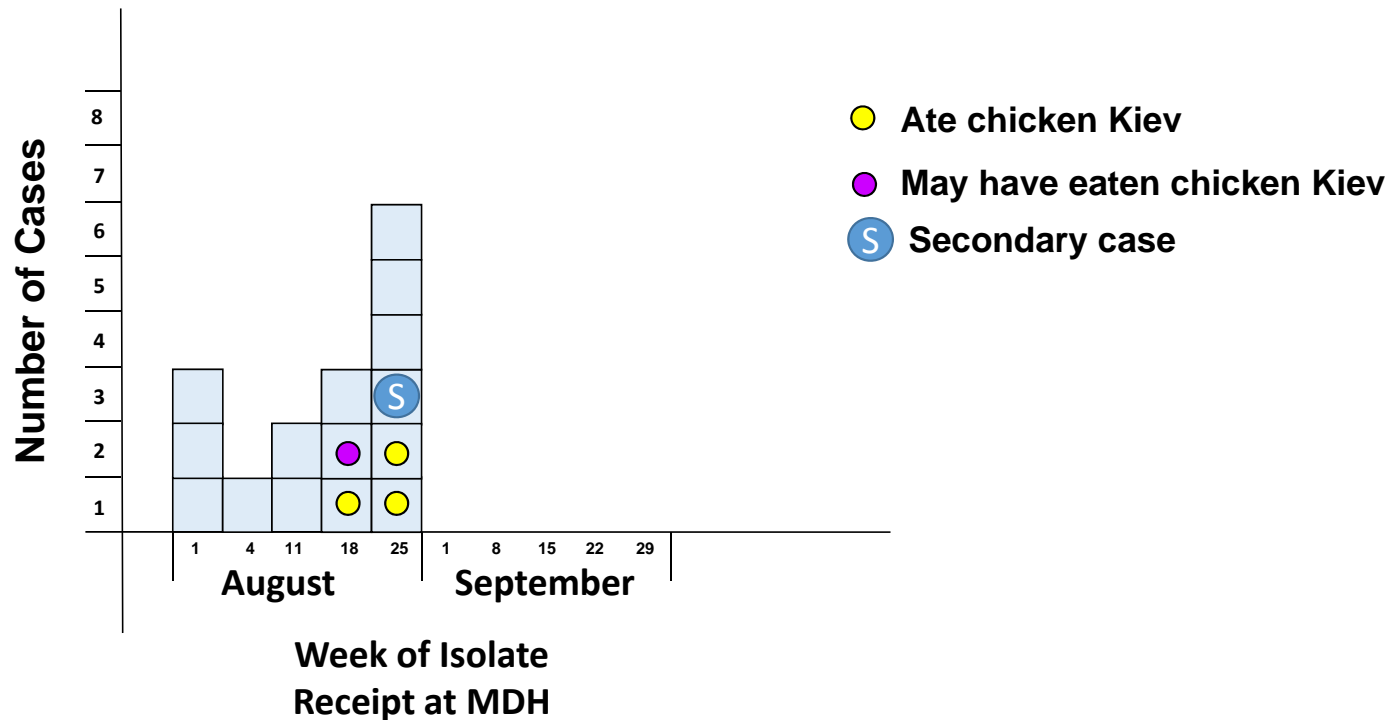
## ***Salmonella* Outbreaks Associated with Stuffed Chicken Products**

- **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**

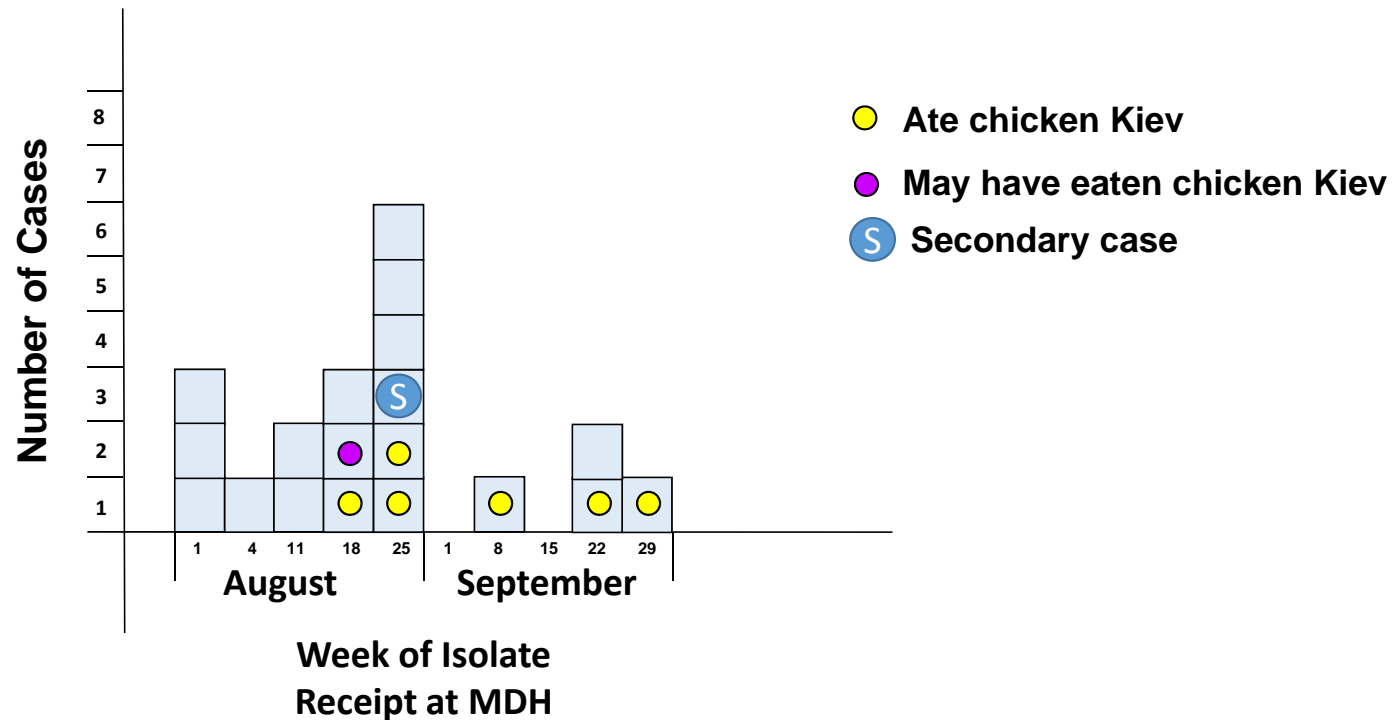
**All *Salmonella* Enteritidis JEGX01.0004/JEGA26.0002  
Isolates Received August-September 2014  
(n=19)**



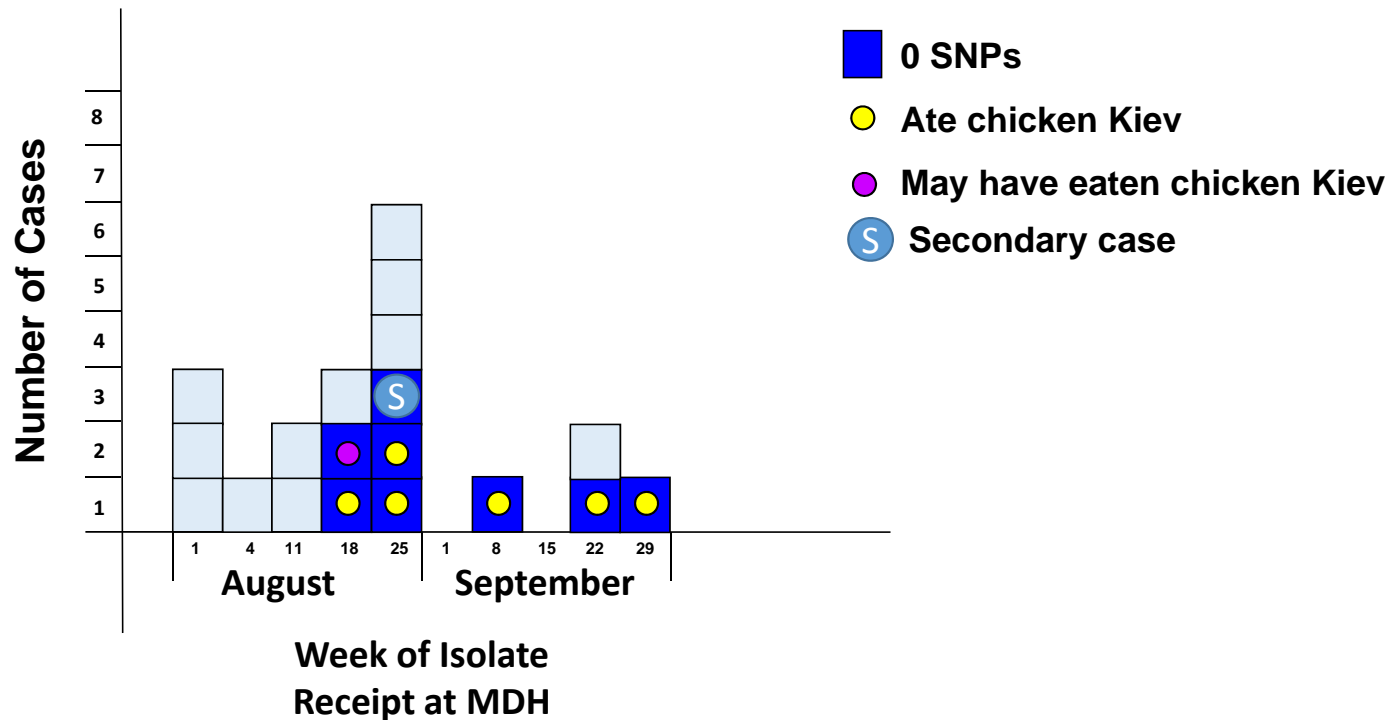
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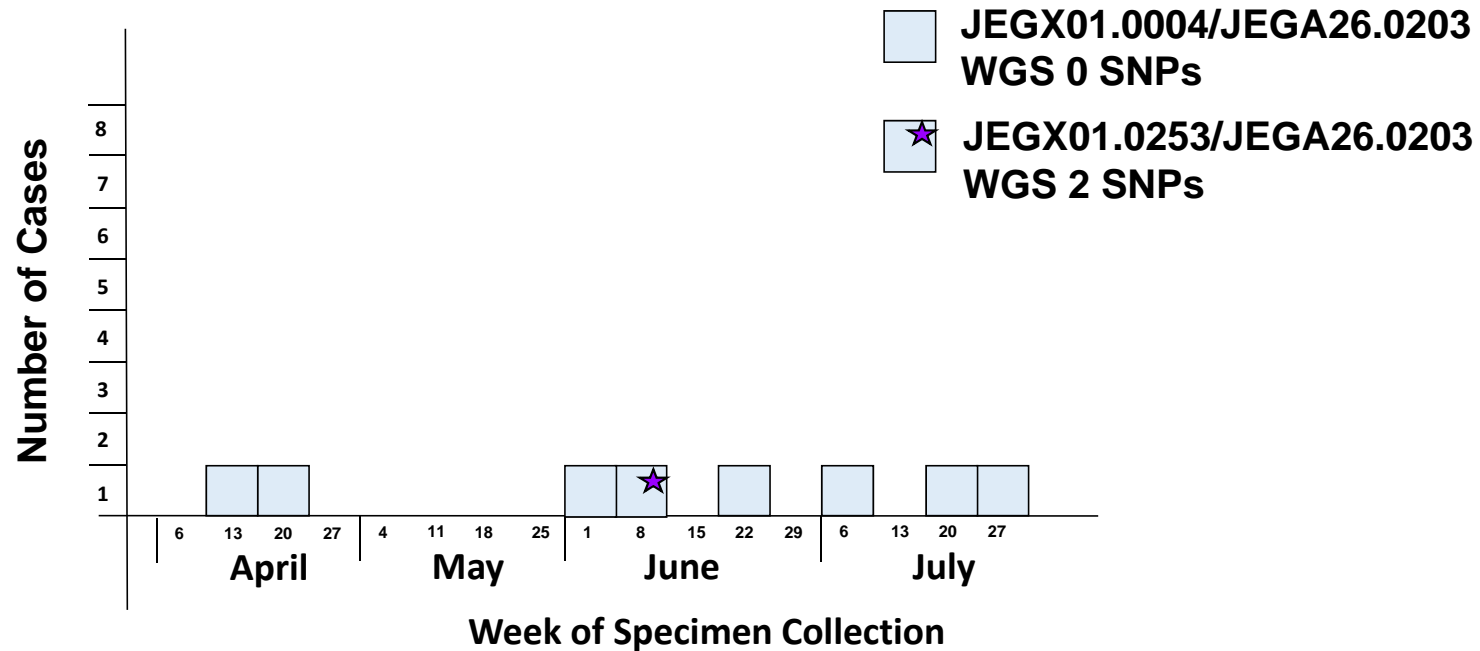
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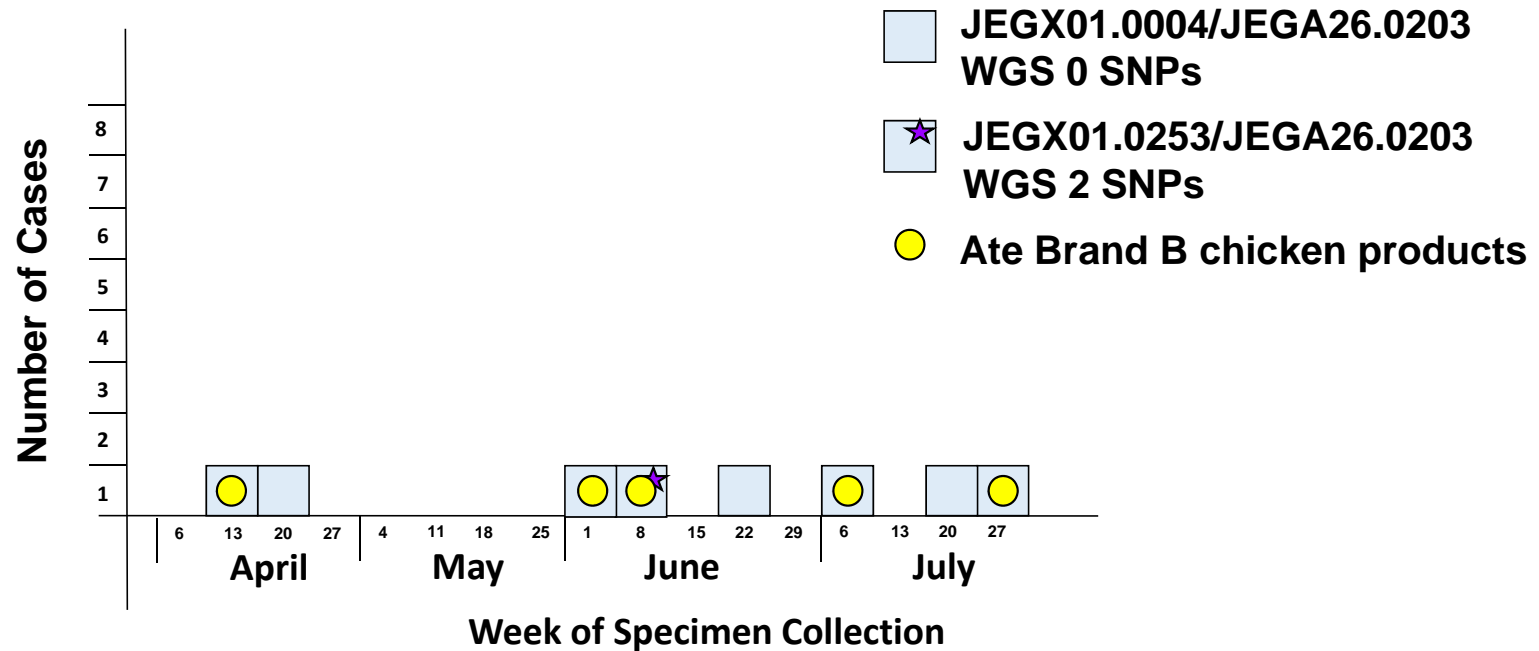
# All *Salmonella* Enteritidis JEGX01.0004/JEGA26.0002 Isolates Received August-September 2014 (n=19)



# ***Salmonella* Enteritidis Cases, Brand B Stuffed Chicken Investigation by Date of Specimen Collection, April-July 2015 (n=8)**



# Salmonella Enteritidis Cases, Brand B Stuffed Chicken Investigation by Date of Specimen Collection, April-July 2015 (n=8)



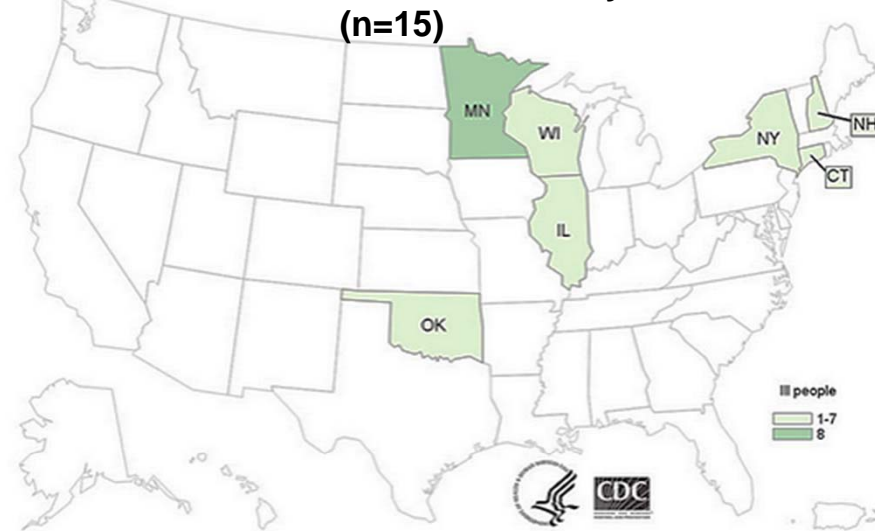
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2015	S. Enteritidis	SE1B239 JEGX01.0004/JEGA26.0203	P-C P-D	15 (MN, IL, CT, NH, NY, OK, WI)

**LABEL CHANGES  
March, 2006**



# 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



State	Ill people
Connecticut	1
Illinois	2
Minnesota	8
New Hampshire	1
New York	1
Oklahoma	1
Wisconsin	1
Total ill people	15

<http://www.cdc.gov/salmonella/frozen-chicken-entrees-07-15/map.html>

# 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



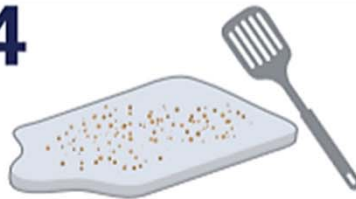
Follow cooking instructions exactly as written.

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**



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## News Release

Release No. 0032.16

Contact:

Office of Communications (202)720-4623

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### 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.

UNITED STATES DEPARTMENT OF AGRICULTURE  
FOOD SAFETY AND INSPECTION SERVICE  
WASHINGTON, DC

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<b>FSIS NOTICE</b>	15-16	2/18/16
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**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!**

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