

The Peanut Gallery:

Dissecting an Example of a Multistate Foodborne Outbreak Response

Katie Sheline, MPH

MDCH Surveillance and Infectious Disease
Epidemiology Section



***S.* Typhimurium Outbreak, 2008-9**

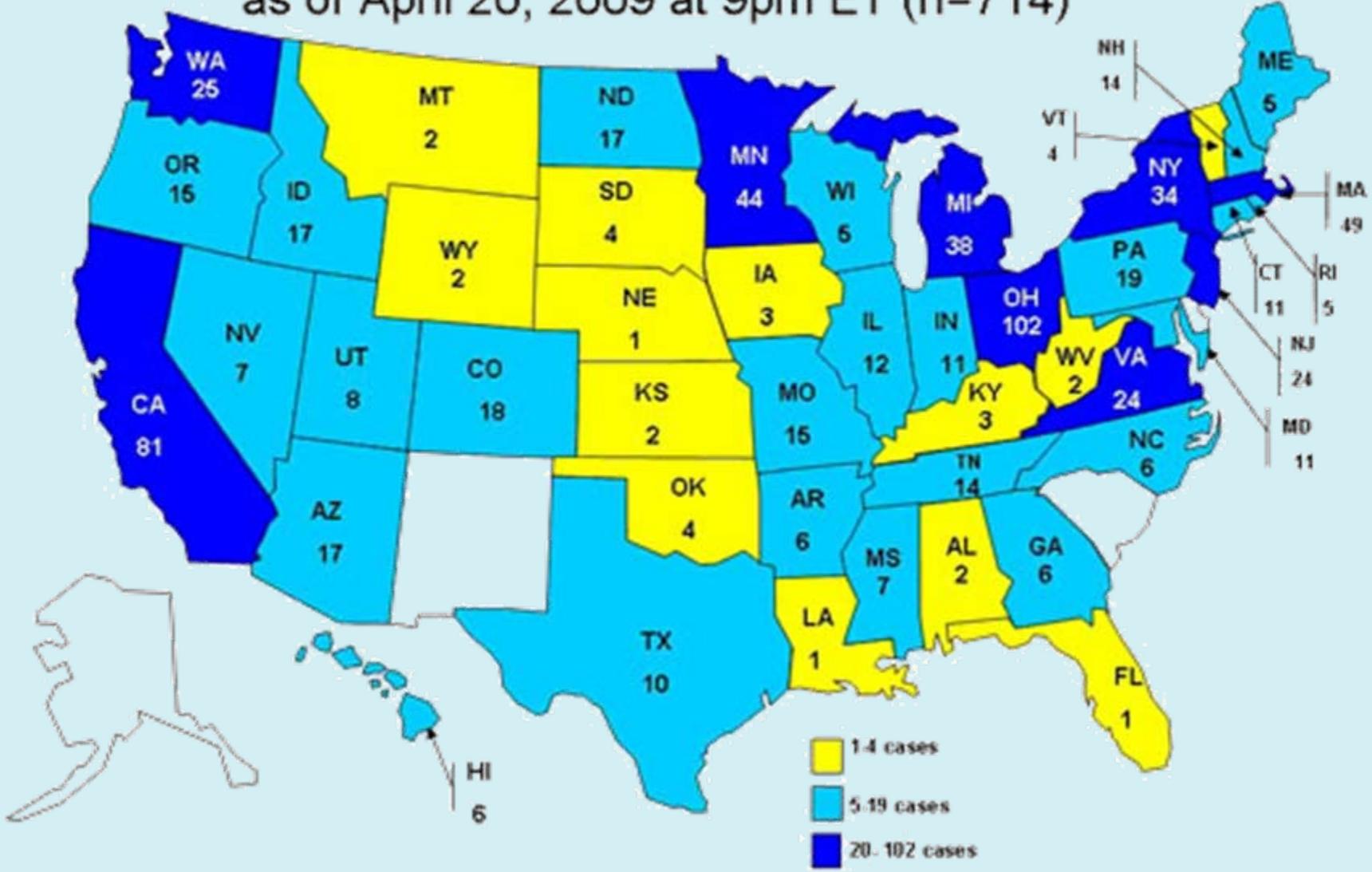
Peanut butter and peanut-containing products

- **Michigan outbreak summary:**
 - **38 confirmed cases**
 - **15 jurisdictions**
 - **Onsets range from 10/11/08 – 2/8/09**
 - **Ages: <1-87 years (median 12 years)**
 - **Sex: 58% male**
 - **12 hospitalizations (32%)**



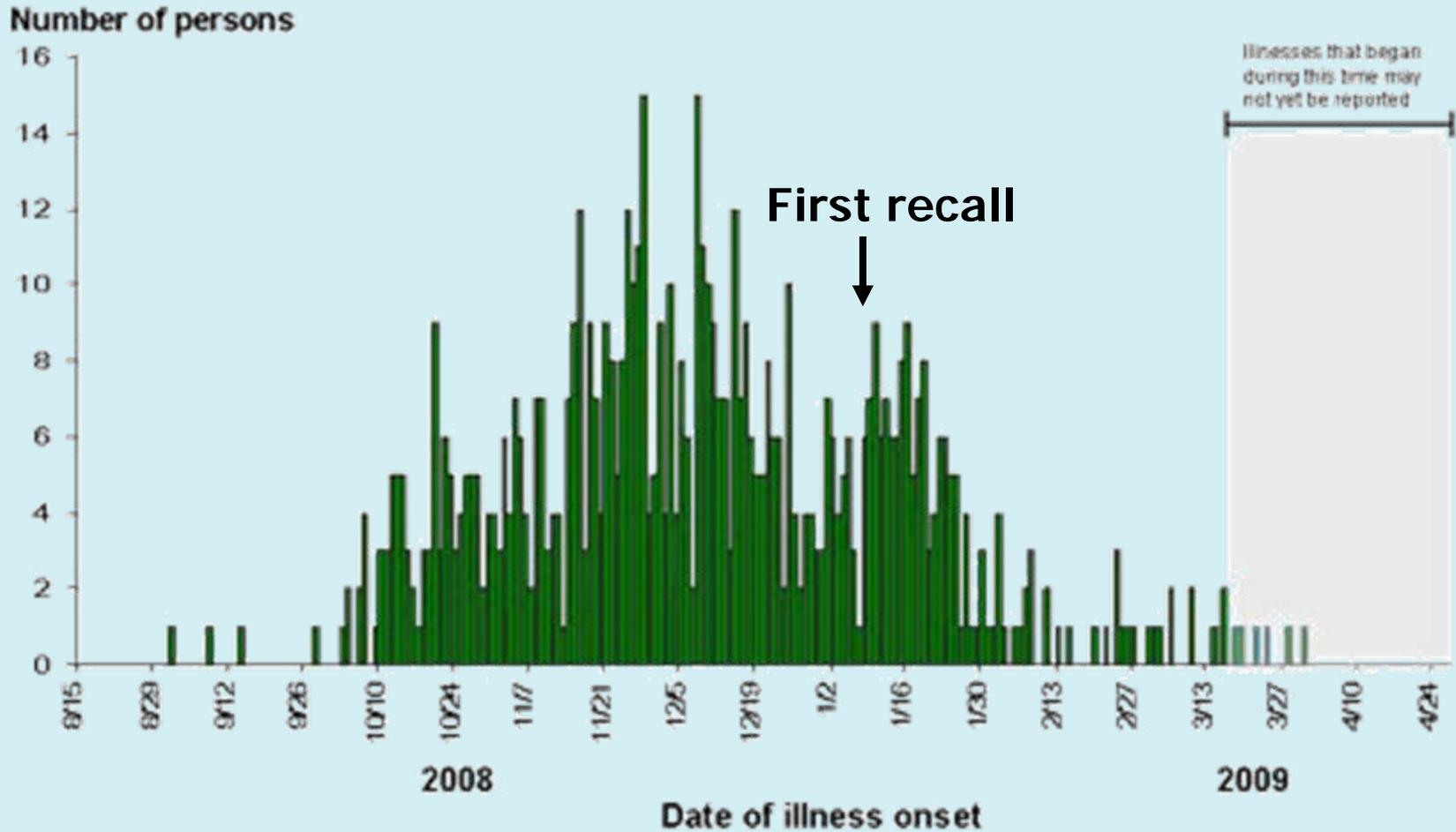
Cases infected with the outbreak strain of *Salmonella* Typhimurium, United States, by state, as of April 20, 2009 at 9pm ET (n=714)

+1 Canada



Infections with the outbreak strain of *Salmonella* Typhimurium, by date of illness onset

(n=696 for whom information was reported as of April 20, 9pm EDT)

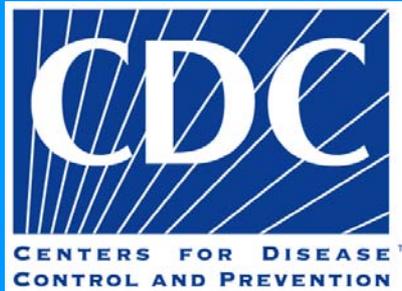


*Some illness onset dates have been estimated from other reported information

Investigation Partners

Public Health

Food Regulatory



CD

Laboratories

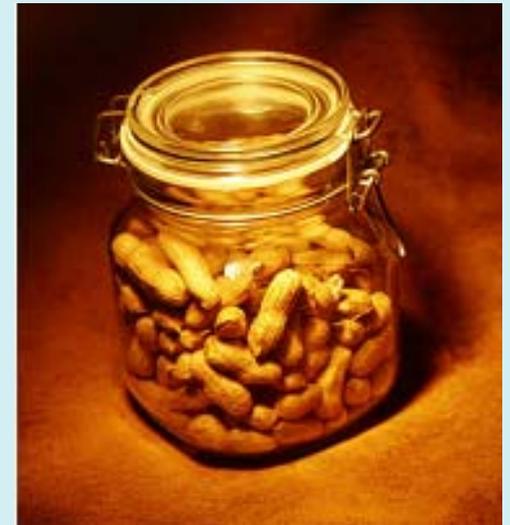
EH

Local Health Departments



Stages of an Epi Investigation

- Cluster detection
- Early investigation
- Hypothesis generation
- Special case/cluster investigation
- Hypothesis testing
- Intervention
- **Information sharing**



Lab-based Enteric Surveillance

- Voluntary submission of clinical isolates to MDCH lab
 - *Salmonella*, *Shigella*, *Listeria*, shiga-toxin producing *E. coli* (STEC)
 - *Salmonella* Serotyping
 - Top 5: **Typhimurium**, Enteritidis, Heidelberg, Newport, Oranienburg
 - Pulsed-field gel electrophoresis (PFGE)
 - Results uploaded to PulseNet
 - Enables national comparisons



Lab Subtyping and Detection

- **PulseNet detects molecular clusters**
 - 50+ clusters reported by MDCH lab, 2008
 - More than half assigned a national cluster code
- **Questions:**
 - How rare is the subtype?
 - **Is this a common-source outbreak?**



NOV
10

NOV
24



Multiple Cluster Investigation

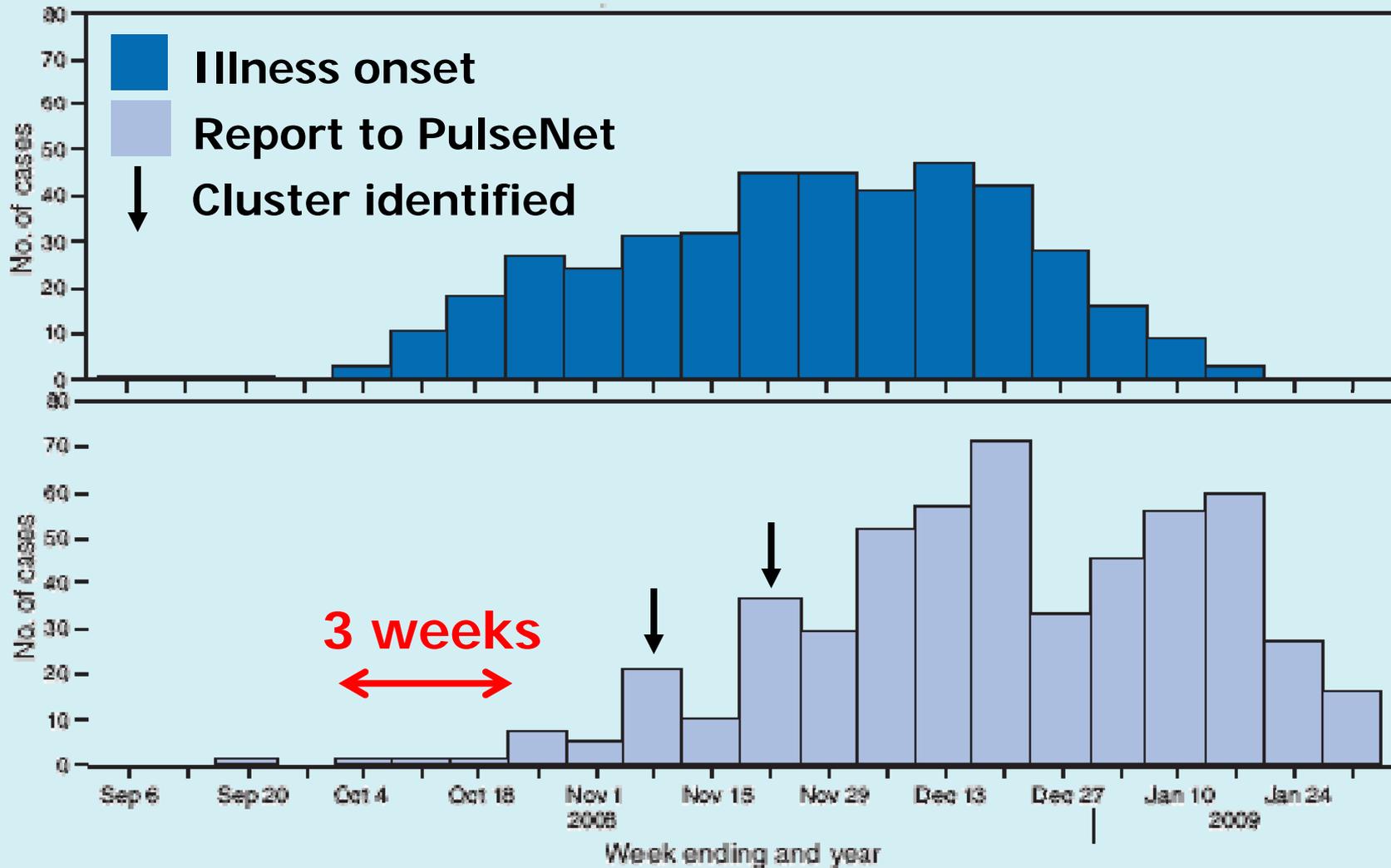
- **Similar PFGE patterns**
 - **New** in the national database

DNA Fingerprint ID (PFGE Pattern*)	PFGE Image
JPXX01.1818	
JPXX01.1825	
JPXX01.0459	

- **Is this ONE common-source outbreak?**



Reporting/Investigation Delays



Early Investigation Methods

- **Small numbers of cases involved**
- **Use of available exposure information**
 - In Michigan, the standard MDSS form
- **Descriptive epidemiology**
- **Historical information**

In early comparisons, no common exposure stood out – but **many cases were children, and many cases had exposure to institutions.** There were no notable similarities to the 2006-7 S. Tennessee Peter Pan PB outbreak

NOV
25



Hypothesis Generation

- 'Shotgun' questionnaire
 - 455+ items (Y/N)
 - PB on pg 10, crackers on pg 8

[xii]Y	?	N	FOODS POPULAR WITH CHILDREN
A	<input type="checkbox"/>	<input type="checkbox"/>	snack cookies <i>If yes, type and brand</i> _____
B	<input type="checkbox"/>	<input type="checkbox"/>	crackers <i>If yes, type and brand</i> _____
C	<input type="checkbox"/>	<input type="checkbox"/>	Goldfish crackers
D	<input type="checkbox"/>	<input type="checkbox"/>	Graham crackers (brand/type) _____
E	<input type="checkbox"/>	<input type="checkbox"/>	Pediasure or similar product
F	<input type="checkbox"/>	<input type="checkbox"/>	Other nutritional drinks
G	<input type="checkbox"/>	<input type="checkbox"/>	Macaroni & Cheese (specify home made or boxed with powdered cheese <i>if yes, Specify brand/type</i> _____

Hypothesis Generation: Results

- **Shotgun tool success depends on outbreak vehicle being included**
- Consider percent of cases exposed
- Compare frequencies to population data (FoodNet survey)
- Partial results:
 - Chicken 85% cases 86% FoodNet
 - PB 77% cases 59% FoodNet



Special Cases/Situations

- May provide opportunities, challenges
- “Outliers”
 - In terms of person, place or time
- Limited diet/exposures
 - Institutionalized cases ← MI: Juvenile facility
 - Travelers
- Clusters ← OH: Concurrent restaurant cluster of *S. Typhimurium* – chicken suspected

Hypothesis Testing

- **Case Control Study (CaCo)**
 - Subset of cases included
 - LHD typically interviews cases
 - CDC typically assists with interviewing controls (**matched** by phone/address)
- **NEW questionnaire**
 - Usually shorter, more focused
 - May include a few items to rule out

CaCo1: Chicken vs. Peanut Butter

Frozen chicken*

mOR = **4.61**, p=0.002

35% of cases

14% of controls

NO association with any individual chicken product ($\leq 10\%$ each)

*chicken nuggets, strips, and other breaded and stuffed chicken products

Any PB

mOR = **2.53**, p=0.007

69% of cases

48% of controls

NO association with roasted peanuts or national brands of jarred peanut butter



The Minnesota Investigation

- **Special situations**
 - Clustering of cases
 - Institutionalized cases
- **Supporting information**
 - Review of facility records
 - Lab testing of suspect food product
 - Opened container **Salmonella positive**, Jan 9
 - First recall: King Nut peanut butter, Jan 11



fda.gov

DEC 28 — JAN 09



CaCo2: PB-Containing Products

- King Nut PB manufactured by PCA
 - Many other consignees of PCA product
 - **Suspect ingredient-driven outbreak**
 - Simultaneous traceforward (FDA)
- Study to evaluate other products
 - **Austin and Keebler brand PB crackers**
 - Power considerations (sample size)
 - Note: often, not all cases in an outbreak are explained

JAN
17



Michigan Case Exposures

- **Exposures to recalled product**
 - **Identified exposure** **18 (47%)**
 - King Nut PB 2 (+4)
 - Austin/Keebler PB crackers 8
 - Other/multiple 4
 - Uncertain exposure 6 (16%)
 - Unknown (not asked) 6 (16%)
 - **No identified exposure** **5 (13%)**
- **Possible secondary case** **3 (8%)**



Feedback Loops

- **New possibly related cases**
 - **Strains discovered via outbreak testing**

Organism

Source

S. Tennessee **Unopened King Nut PB**
(2 PFGE patterns*)

S. Mbandaka **Georgia PCA plant (floor)**

S. Senftenberg **Georgia PCA plant (floor)**

***2006-7 Peter Pan PB outbreak patterns**



Questionnaires over Time

Gastrointestinal Illness Case Investigation
Salmonellosis
Michigan Department of Community Health
Communicable Disease Division

Investigation Information

Investigation ID: _____ Case Date: _____ Investigation Date: _____ Referral Date: _____ Case Entry Date: _____ Case Completion Date: _____

Investigation Status: Open Closed Completed Suspended Cancelled

Case Status: Confirmed Under a Case Probable Suspected Unknown

Investigator: _____ Patient Status: _____ Patient Status Date: _____ Start of an outbreak: _____ Outbreak Name: _____ Case Type/Date: _____

Patient Information

Patient ID: _____ First: _____ Last: _____ Middle: _____

Street Address: _____

City: _____ County: _____ State: _____ Zip: _____

Home Phone: _____ Ext: _____ Other Phone: _____ Ext: _____

Parent/Guardian (required if under 18): _____ First: _____ Last: _____ Middle: _____

Demographics

Sex: Male Female Unknown

Date of Birth: _____ Age: _____ Age Unit: _____

Race: Caucasian African American American Indian/Alaska Native Other (Specify): _____

Education: High School Some College Bachelor's Degree Graduate Degree

Referral Information

Referring Physician: _____ First: _____ Last: _____ Phone: _____ Ext: _____ Email: _____

Street Address: _____

City: _____ County: _____ State: _____ Zip: _____

CDC ID: _____ CDC PulseNet ID: _____

Salmonella Typhimurium Hypothesis Generating Questionnaire (Cluster 0811CDCPPC-1 and 0811ML3PC-1) page 2 of 6

I will be asking you questions about the 7 days before your child got sick. We place asterisks on the food you or your child ate between **DATE** and **DATE**, unless I specifically ask about a different time period. I will begin by asking questions about your child's illness.

Respondent as: self parent spouse other (specify) _____

Relationship: _____ Ethnicity: _____ State of Residence: _____

What date did your child first feel ill? (mm/dd/yyyy) _____ What time did your child first feel ill? _____ am _____ pm

What date did your child first come to (mm/dd/yyyy) _____ What date did your child first have diarrhea? (mm/dd/yyyy) _____

GENERAL INFORMATION

Yes No Unsure Not applicable

1. Were you or your household ever with diarrhea or vomiting in the week before your child got sick? (If yes, how long was it?)

2. Were you or your household ever with diarrhea or vomiting in the week before your child got sick? (If yes, how long was it?)

3. Did you or your child spend any time out of your home city in the 7 days before your child got sick?

4. Did you or your child eat any food, were you or your child on any kind of special or restricted diet for medical, allergy, weight loss, religious, or other reason?

5. Were you or your child being antibiotic for any reason in the month before your child got sick?

6. Did your child visit an emergency room because of this illness?

7. Were you or your child hospitalized overnight? If yes, how many days in the hospital?

8. During the 7 days before you got sick, did you live in an institutional setting (boarding or assisted living home, detention center, etc.)?

9. During the 7 days before you got sick, did you attend a school, college, or daycare?

10. During the 7 days before you got sick, did you participate in any special activities or programs (e.g., swimming lessons, camps, church activities, religious services or religious retreat, etc.)? If yes, specify: _____

11. Do you know anyone else in your neighborhood or other community health district, etc. with a similar illness? If yes, identify: _____

12. How many people? _____ Do you have a contact name and number so we can call them for more information? Name: _____ Phone: _____

13. Do you make a point to select locally "organic" produce when you shop?

14. Are you or your child a vegetarian or vegan? If yes, do you eat: _____

Now I will ask you about the types of places where your child might have eaten in the 7 days before your child got sick. This may help jog your memory about specific food items, which I'll ask you about in a few minutes. In the 7 days before this illness, did your child eat anything or any:

Yes No Unsure Not applicable

EATING AND DRINKING VENUES

1. Cafeteria or dining room such as a hospital, school, or college

2. Fast-food restaurants

3. Sit-down restaurants

4. Grocery store and/or other food store

5. Bakery, canteen, or pastry shop

6. Office or law shop such as a doctor's office

7. Street vendor/sit-down establishments

8. Street vendor/sit-down stand at a sporting event, county fair, or concert

9. Gas stations, truck stops, mini-marts

10. Shopping mall or airport food courts

11. Ice cream, cafe, and dessert shops

12. Taverns or bar

13. Food service, special, and banquet kitchen

14. Food service (kitchen) that those at Costco, Trader Joe's, farmers' markets or other places

15. Eating home or assisted living or retirement center dining facility

16. Hotel/room service or food or mobile foodservice

Case: _____ Cluster Code (CDC or PulseNet): _____ Subtype ID: _____ CDC Case ID: _____

PRE-INTERVIEW QUESTIONS (Answer "I don't know" if you are unsure of the information requested or if you are not sure)

1. Interviewed by: _____ 2. Interview date: mm ____ dd ____ yyyy ____

3. Respondent: self parent Other: _____

4. Case # (Salmonella): _____ 5. Case # (EHEC): _____ 6. Case # (EPEC): _____

7. City or Residence: _____

8. County or Residence: _____

9. City or Residence: _____

10. Interviewed with Spanish Translator? Yes No

11. Interviewer's name: _____ and I'm working with the _____ Department of Health. I'm calling to interview you about an ongoing outbreak of illness caused by Salmonella, and to remind you that you may be asked to provide information about your illness and to take a few more questions that would take approximately 15 minutes to two days. An emergency contact will remain confidential and we would like to answer any question you or your child have or service. Would you be willing to answer a few questions at this time?

If "NO": "I would really use your help in this investigation to find out the cause of this illness and to help prevent others from becoming sick. I would only take approximately 15 minutes to two days. Some information about an outbreak is not a first-priority? Does it make sense? (CDC/PH) Time is valuable. Call me back." (CDC/PH)

If "YES": Great, thank you. Let's get started.

I will be asking you some questions about your illness and foods you may have eaten in the 7 days before you became ill. Would you like to get a calendar to look at these dates before we get started?

Month	Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Jan	1	2	3	4	5	6	7	8
Feb	9	10	11	12	13	14	15	16
Mar	17	18	19	20	21	22	23	24
Apr	25	26	27	28	29	30	31	
May	1	2	3	4	5	6	7	8
Jun	9	10	11	12	13	14	15	16
Jul	17	18	19	20	21	22	23	24
Aug	25	26	27	28	29	30	31	
Sep	1	2	3	4	5	6	7	8
Oct	9	10	11	12	13	14	15	16
Nov	17	18	19	20	21	22	23	24
Dec	25	26	27	28	29	30	31	

First, I will ask you a few questions about your (your child's) illness. Throughout this interview, some questions may seem repetitive and we appreciate your patience but it is important for us to ask every one of your illness questions.

Subtype 1: Onset dates and times (use multiple answers to best describe your illness)

2.1. On what date did you (your child) first feel sick? mm ____ dd ____ yyyy ____

2.2. On what date did you (your child) first have diarrhea? mm ____ dd ____ yyyy ____

Case: _____ PulseNet ID: _____ CDC Case ID: _____

Salmonella Typhimurium (Cluster 0811CDCPPC-1 and 0811ML3PC-1)
Case Cluster Study #2 and Case-Series - Version 1, Final 1/14/09

CASE SERIES QUESTIONNAIRE

Interviewed by: _____ Interview date: mm ____ dd ____ yyyy

Interviewer Affiliation: EBOC Volunteer EDEB Staff State Health Department Local Health Department

Respondent: self parent Other (who): _____

Case's Age: _____ years or _____ months (note month of case if < 1 year)

Case's SOC: _____

County of Residence: _____ City of Residence: _____

Interview Conducted with Spanish Translator? Yes No

Introduction

Hello, my name is _____ and I'm working with the _____ Department of Health. The reason I'm calling is because we are investigating an outbreak of illnesses caused by salmonella, and we need your help. We understand that your child was infected with salmonella. Is that correct?

You may have already talked with someone about your illness. We need to ask a few more specific questions that would take approximately 10 minutes or less. Any information provided will remain confidential and you wouldn't have to answer any question that you don't want to answer. Would you be willing to answer a few questions at this time?

"NO": We could really use your help in this investigation to find out the cause of these illnesses and to help prevent others from becoming sick. It should only take approximately 10 minutes or less. Is there a better time to call back to ask a few questions? _____ Time to call back: _____

"YES": Great, thank you. Let's get started.

I will be asking you some questions about your illness and foods you may have eaten in the 7 days before your diarrhea started. Would you like to get a calendar to look at these dates before we get started?

Month	Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Jan	1	2	3	4	5	6	7	8
Feb	9	10	11	12	13	14	15	16
Mar	17	18	19	20	21	22	23	24
Apr	25	26	27	28	29	30	31	
May	1	2	3	4	5	6	7	8
Jun	9	10	11	12	13	14	15	16
Jul	17	18	19	20	21	22	23	24
Aug	25	26	27	28	29	30	31	
Sep	1	2	3	4	5	6	7	8
Oct	9	10	11	12	13	14	15	16
Nov	17	18	19	20	21	22	23	24
Dec	25	26	27	28	29	30	31	

We would like to ask you some questions about your illness.

1. On what date did you (your child) first feel sick? mm ____ dd ____ yyyy ____

1.1. On what date did you (your child) first start having diarrhea? mm ____ dd ____ yyyy ____ Did not have diarrhea

1.2. Did you (your child) visit a health care provider for your illness? Yes No DK

1.3. How many days were you sick? _____ day(s) Sick

1.4. Did you (your child) visit an emergency room for your illness? Yes No DK

1.5. Were you (your child) hospitalized overnight? Yes No DK

1.6. Did you (your child) receive antibiotics as treatment for this illness? Yes No DK

Page 1 of 7

MDSS Q
5 pages

Shotgun Q
14 pages

CaCo1 Q
10 pages

CaCo2 Q
7 pages

open-ended
food history

PB: Y/N

PB (detail), PB
products (Y/N)

PB, PB
products
(detail)



Coordination and Communication

- Regular teleconferences
- CDC case reporting deadlines
- MI Health Alert Network (MIHAN) messages
- Secured file sharing
 - CDC FTP site, MIHAN
- Public websites
 - CDC, FDA

DEC
10



JAN
08



Enteric Investigation Tips

- **Routinely**
 - Collect detailed food histories/preferences
 - Prepare cases for possibility of recontact
- **During an active investigation**
 - Gather supplemental documents
 - menus, receipts, customer cards, invoices
 - Consider early questioning (casefinding)
 - Collect detailed product information
 - Pursue product testing opportunities



Additional References

- **Outbreak MMWR:**

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm58e0129a1.htm>

- **CDC outbreak timeline:**

http://www.cdc.gov/salmonella/typhimurium/salmonellaOutbreak_timeline.pdf

- **FDA outbreak timeline:**

<http://www.fda.gov/oc/opacom/hottopics/salmonellatypH/timeline.pdf>

