

Multistate Outbreak of *Salmonella* Bovismorbificans Infections Associated with Mediterranean-Style Restaurants — United States, 2011

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Outbreak Detection

3 *Salmonella* Bovismorbificans isolates identified

Salmonella case interviews reviewed

PulseNet query requested

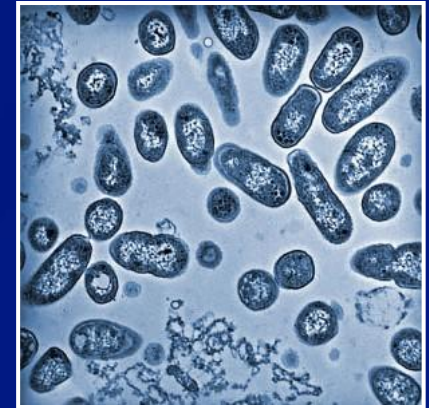
PulseNet identified 6 additional cases

CDC Cluster Code (n=9)



Salmonellosis

- ❑ 40,000 cases and 400 deaths yearly
- ❑ Illness onset 12–72 hours after exposure
- ❑ Mild to severe gastrointestinal symptoms
- ❑ Estimated 29 non-reported cases per 1 reported case



Objectives

1. **Identify the vehicle and source of outbreak**
2. **Identify additional cases to define scope of outbreak**
3. **Prevent further illness**

Case Definition

- ❑ **Laboratory-confirmed *S. Bovismorbificans* infection**
- ❑ **Indistinguishable pulsed-field gel electrophoresis (PFGE) pattern**
- ❑ **Any U.S. location**
- ❑ **Illness onset during August–December 2011**

Case Finding and Interview Methods

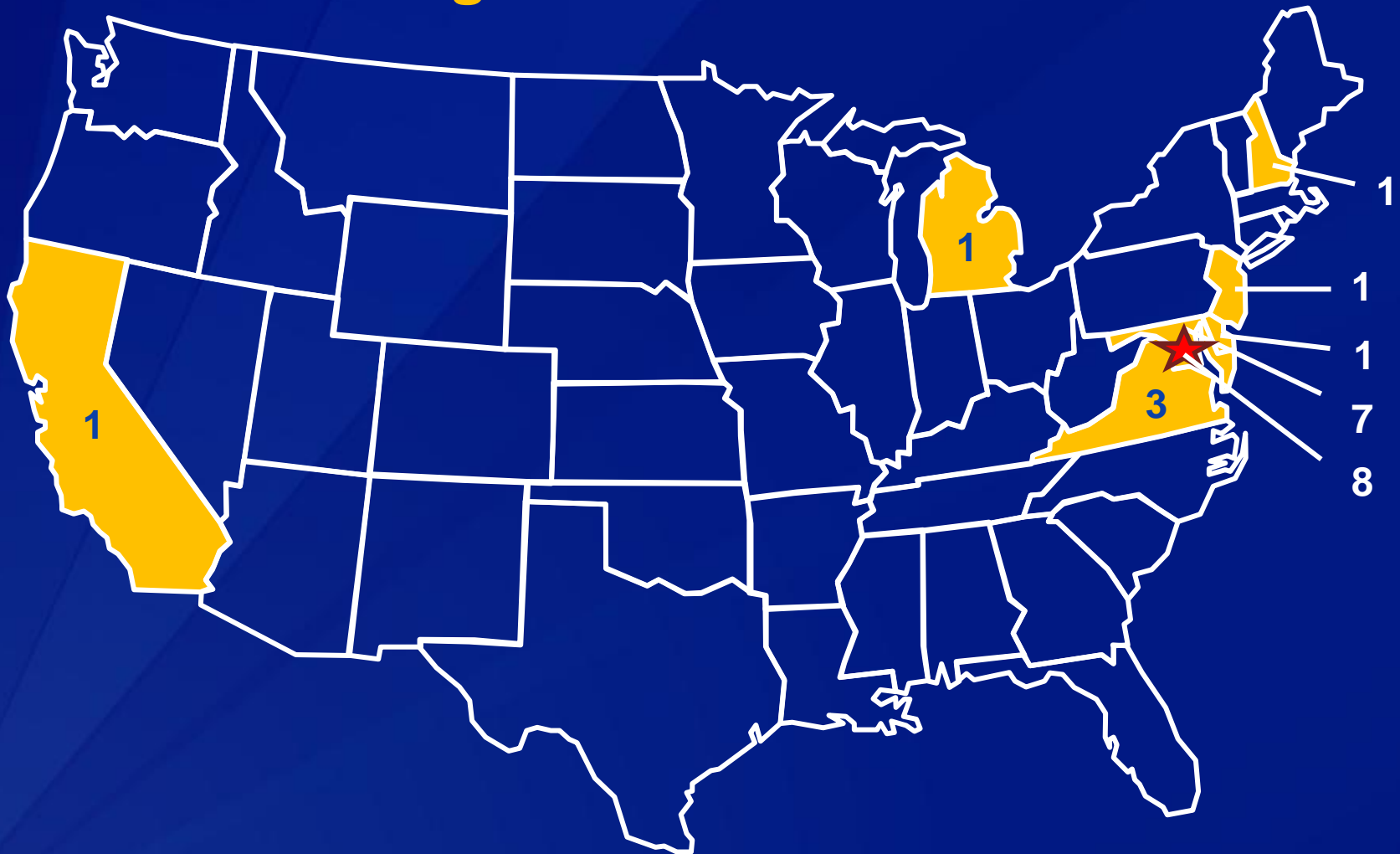
□ Case Finding

- State reporting
- Laboratory testing
- PulseNet monitoring

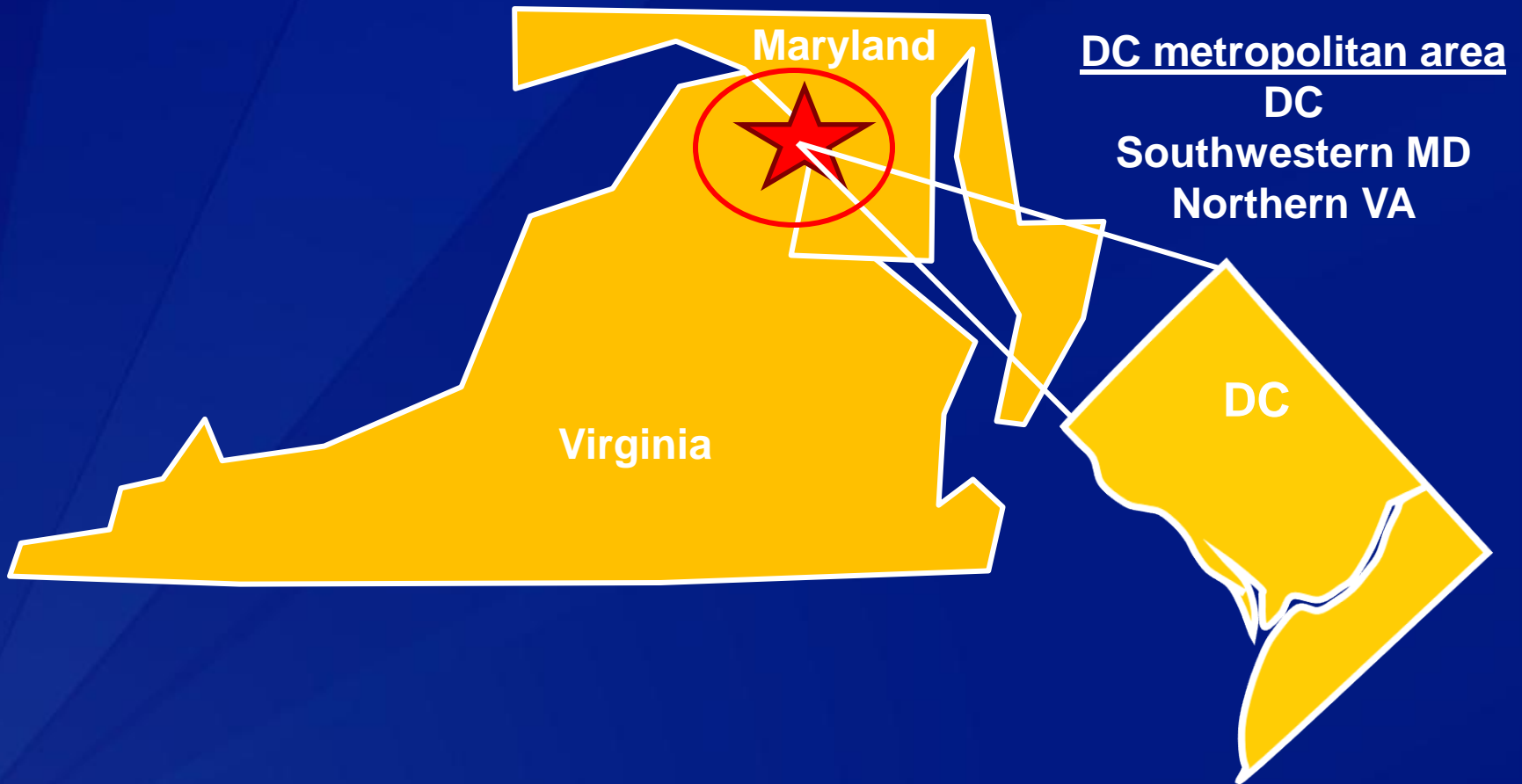
□ Interviews

- Open-ended
- 'Shotgun' questionnaire
- Targeted questionnaire

Location and Number of Cases (N=23), August–December 2011



DC Metropolitan Area

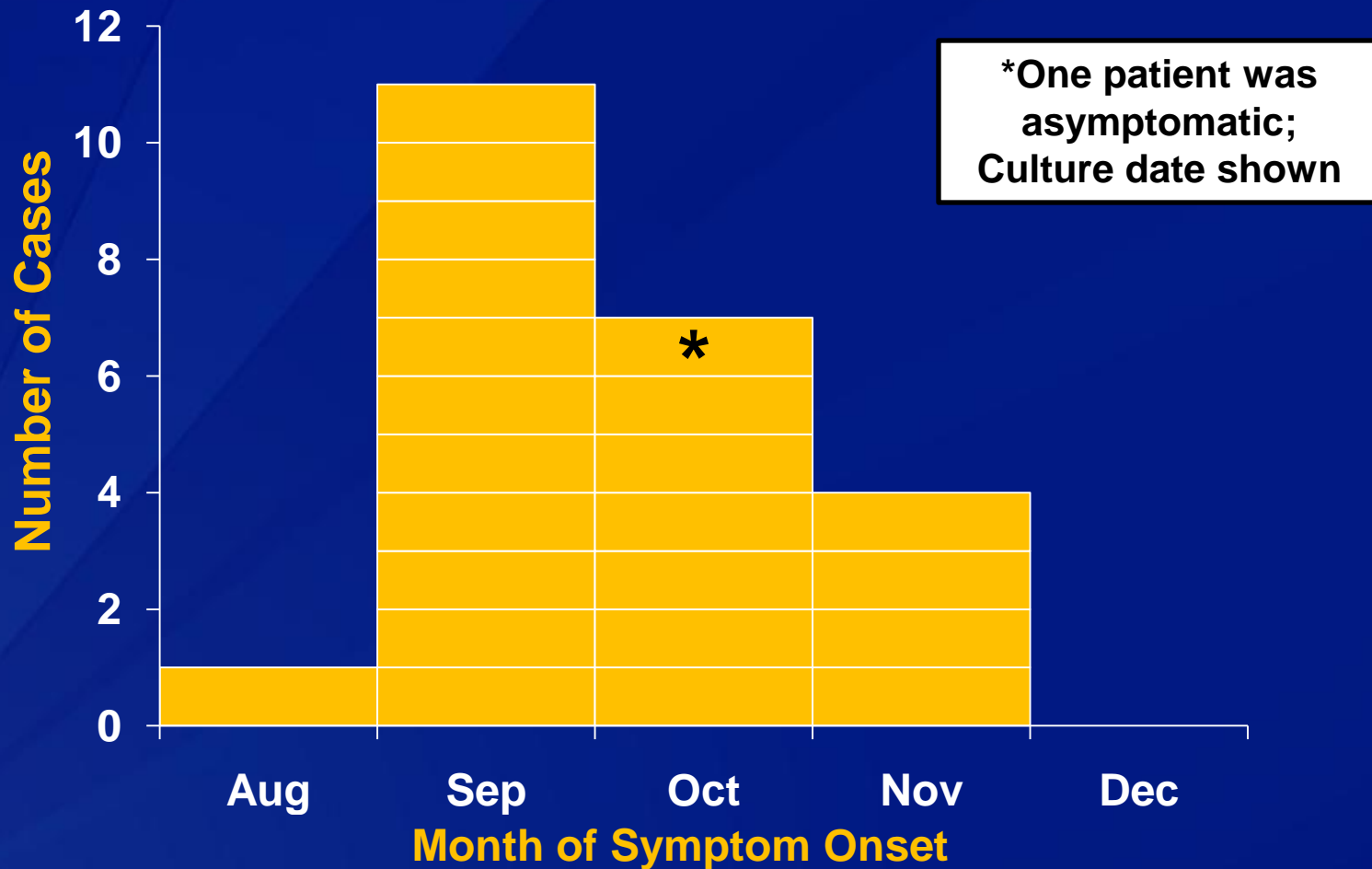


Patient Characteristics (N = 23)

Characteristic

Age in years, median (range)	27 (20–87)
Female, n (%)	13 (57)
Lived or traveled to DC metropolitan area, n (%)	23 (100)
Lived outside of Mid-Atlantic region, n (%)	5 (22)
Hospitalized, n	0
Deaths, n	0

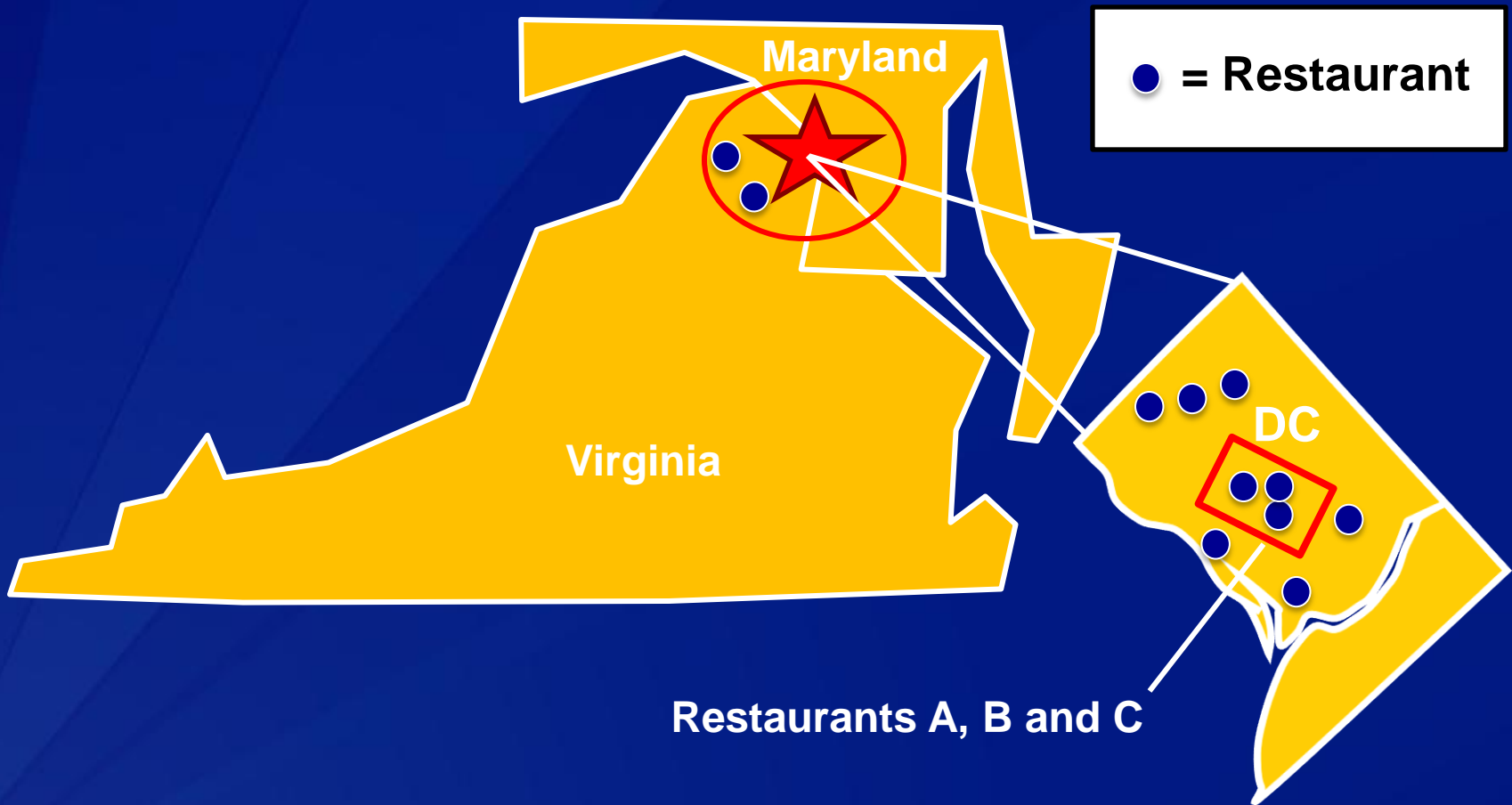
Cases of *Salmonella Bovismorbificans* by Month of Symptom Onset (N=23)



Restaurant and Food Exposures

Exposure	Number reported/interviewed	(%)
Commonly reported foods		
Lettuce	11 / 14	(79)
Chicken	11 / 15	(73)
Tomato	11 / 15	(73)
Cucumber	9 / 11	(82)
DC metropolitan restaurant	20 / 22	(91)
Mediterranean-style foods	16 / 18	(89)
Hummus	10 / 15	(67)
Restaurants A, B or C	9 / 13	(69)

Location of Implicated Restaurants

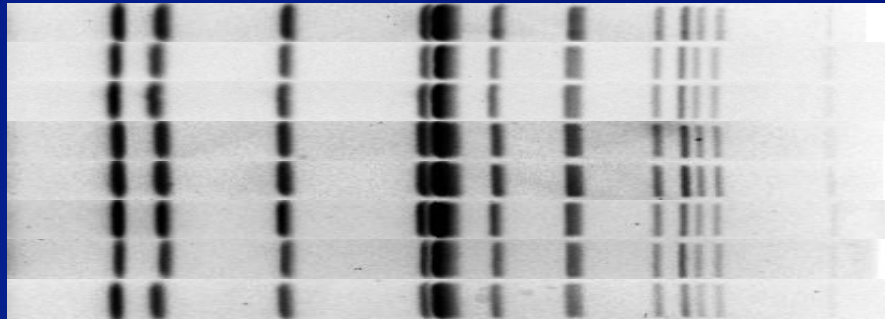


Restaurant Inspections

- ❑ **Conducted inspections at Restaurants A, B and C**
- ❑ **Collected samples for testing**
 - **Food**
 - **Environmental**
 - **Employee**

Indistinguishable PFGE Patterns: New Pattern to PulseNet

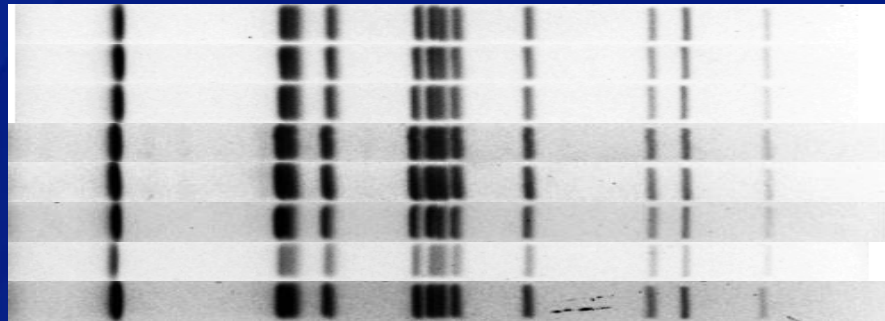
Xba1



DC
Patient
Samples

←
Hummus
Sample 1

Bln1



DC
Patient
Samples

←
Hummus
Sample 1

Foods Tested

Type of Food	Results
Hummus	Salmonella bovismorbificans
Cucumber sauce	No Salmonella sp isolated
Mint leaves	No Salmonella sp isolated
Cumin	No Salmonella sp isolated
Gyro meat	No Salmonella sp isolated
Olive	No Salmonella sp isolated
Olive Oil	No Salmonella sp isolated

**Hummus Sample 1
(Restaurant A)**

Type of Food	Results
Chick peas	No Salmonella sp isolated
Garlic	No Salmonella sp isolated
Tahini	No Salmonella sp isolated
Hummus	Salmonella bovismorbificans
Hummus	Salmonella bovismorbificans
Tahini	No Salmonella sp isolated

**Hummus Samples 2 and 3
(Restaurants A and B)
Samples taken 10 days later**

Testing of Hummus Ingredients



Chickpeas



Garlic



Lemon
juice



Tahini



Olive oil



Salt



Laboratory Results

Exposure	Result
Environmental samples	-
Employee stool specimens	-
Food samples	
Prepared hummus	+
Hummus ingredients	-
Commonly reported foods	-

Hummus Ingredient Traceback

- Reviewed purchase orders and shipping invoices

2 Virginia Restaurants

3 DC Restaurants



Virginia Distributor



Tahini Manufacturer in Lebanon

S. Bovismorbificans Isolated From Hummus — Actions Taken

- ❑ **November 2011 — all ingredients used to make hummus were embargoed at Restaurants A, B and C**
 - **Restricted sale and delivery of hummus**
 - **Prohibited use of ingredients in other foods (i.e., sauces)**
- ❑ **Embargo ended January 2012**

UPDATE (as of May 2012) — FDA Traceback Investigation

- ❑ **Two tahini recalls in Canada**
 - *Salmonella* Cubana (September 2011)
 - *Salmonella* Seftenberg (February 2012)
- ❑ **Common ingredient in Mediterranean-style foods**
- ❑ **Same tahini brand used in Restaurant A and Virginia restaurants**
- ❑ **May 30, 2012 — FDA implicated tahini as likely source in *S. Bovismorbificans* outbreak**

Limitations

- ❑ Inconsistent interviewing methodology across jurisdictions
- ❑ Patients unable to recall past restaurant and food exposures
- ❑ Failed to confirm *Salmonella* contamination in tahini with laboratory evidence

Conclusion

- ❑ PulseNet helped identify cases outside of Mid-Atlantic region → Focus on Mediterranean-style restaurants
- ❑ Hummus was the likely vehicle of *Salmonella* infections → Tahini was the likely source
- ❑ Use of tahini in other foods might explain infections in those not reporting hummus exposure
- ❑ Investigating restaurant clusters useful in ingredient-driven outbreaks

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Co-authors highlighted in yellow

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Salmonella Bovismorbificans Infections
Associated with ~~Mediterranean Style Restaurants~~
— United States, 2011**

TAHINI

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Additional Slides

***Salmonella enterica* serotype Bovismorbificans (*Salmonella* Bovismorbificans)**

- ❑ **No prior *S. Bovismorbificans* outbreak in the District of Columbia (DC)**

- ❑ **Only 5 documented outbreaks in U.S. since 2001**
 - **January 2001 – Unknown source and vehicle (Maryland)**
 - **September 2002 – Homemade cheese (Michigan)**
 - **April 2004 – Alfalfa sprouts (Multi-state)**
 - **June 2008 – Pasta salad (Pennsylvania)**
 - **August 2008 – Striped bass (Virginia)**

- ❑ **No reported deaths associated this serotype**

Restaurants A, B and C have the Same Owner



Positive *Salmonella* Cultures



Outbreak Detection

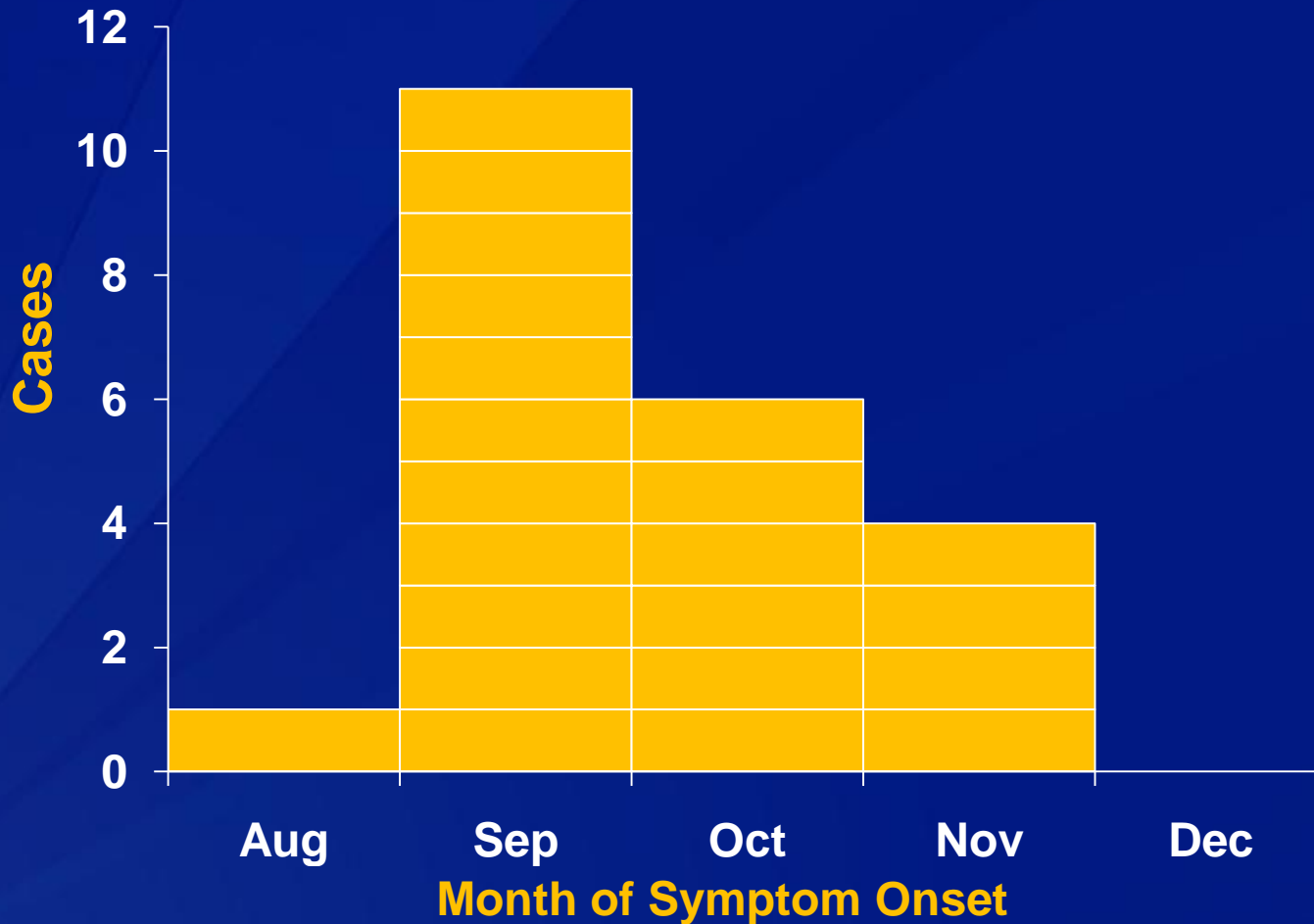
- ❑ **September 27– 3 *Salmonella* Bovismorbificans isolates matching by PFGE identified at District of Columbia (DC) Public Health Laboratory**
- ❑ **October 4 – PulseNet query identified 6 additional *S. Bovismorbificans* cases in multiple states**
- ❑ **October 6 – CDC assigned a cluster ID to 9 cases; new PFGE pattern to PulseNet**



Salmonella Bovismorbificans Outbreaks (2001-present)

Year	State	Total Ills	Total Hospitalizations	Total Deaths	Food Vehicle
2001	Maryland	5	2	0	Unknown Homemade Cheese
2002	Michigan	7	2	0	(unspecified) Alfalfa sprouts
2004	Multistate Pennsylvania	35	5	Unknown	
2008	a	8	2	0	Pasta salad
2008	Virginia	45	1	0	Striped bass

Cases of *Salmonella Bovismorbificans* by Month of Symptom Onset



Excited EIS Officer Taking Food Temperature Measurements



The Hummus Mixer



Environmental and Laboratory Testing Results

- ❑ All environmental samples were negative for *Salmonella*
- ❑ All food handler stool specimens tested negative
- ❑ 33 food samples tested
 - Prepared hummus from Restaurants A and B
 - Hummus ingredients from Restaurant A
 - Other commonly-used food items from all 3 restaurants

Tahini Implicated as Source of Contamination for Hummus

- ❑ Paste from ground sesame seeds
- ❑ Sesame seed composition favorable for *Salmonella*
 - High lipid content
 - Low water permeability
- ❑ Protective for survival, not growth
- ❑ Resistance to high temperatures



Tahini Implicated as Source of Contamination

- ❑ Paste from ground sesame seeds



Cleaned and dehulled

Roasted
(120°C for ≥ 1 hour)

Grounded into a paste
(130°C)



- ❑ Common ingredient in Mediterranean and Middle Eastern foods
- ❑ Multi-step production process