

Getting Ahead of the Curve: Foodborne Outbreak Detection and Response: Case Study

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Foodborne Outbreak Detection

- Local Health Jurisdiction
 - ▶ Customer complaint lines
 - ▶ Outbreak reports
 - ▶ Foodborne illness report
 - ▶ Laboratory reports, PFGE
- State Health Department
 - ▶ Foodborne/Preliminary outbreak reports
 - ▶ *Salmonella* serotyping
 - ▶ Pulsed-field gel electrophoresis (PFGE)
- National
 - ▶ PulseNet



Foodborne Outbreak Scenarios

- Traditional scenario
 - ▶ e.g., church picnic, wedding banquet
 - ▶ acute and highly local
 - ▶ high inoculum, high attack rate
 - ▶ usually event associated, or affects a discrete population; “point-source”
 - ▶ Single jurisdiction
 - ▶ Investigation at LHD level
- Newer scenario
 - ▶ e.g., E. coli in spinach, *Salmonella* in peanut butter
 - ▶ diffuse and widespread outbreak
 - ▶ low-level contamination of widely distributed food product
 - ▶ Multi-jurisdictional
 - ▶ Investigation usually at state/ CDC level

Salmonella Surveillance in California

CA surveillance system is decentralized

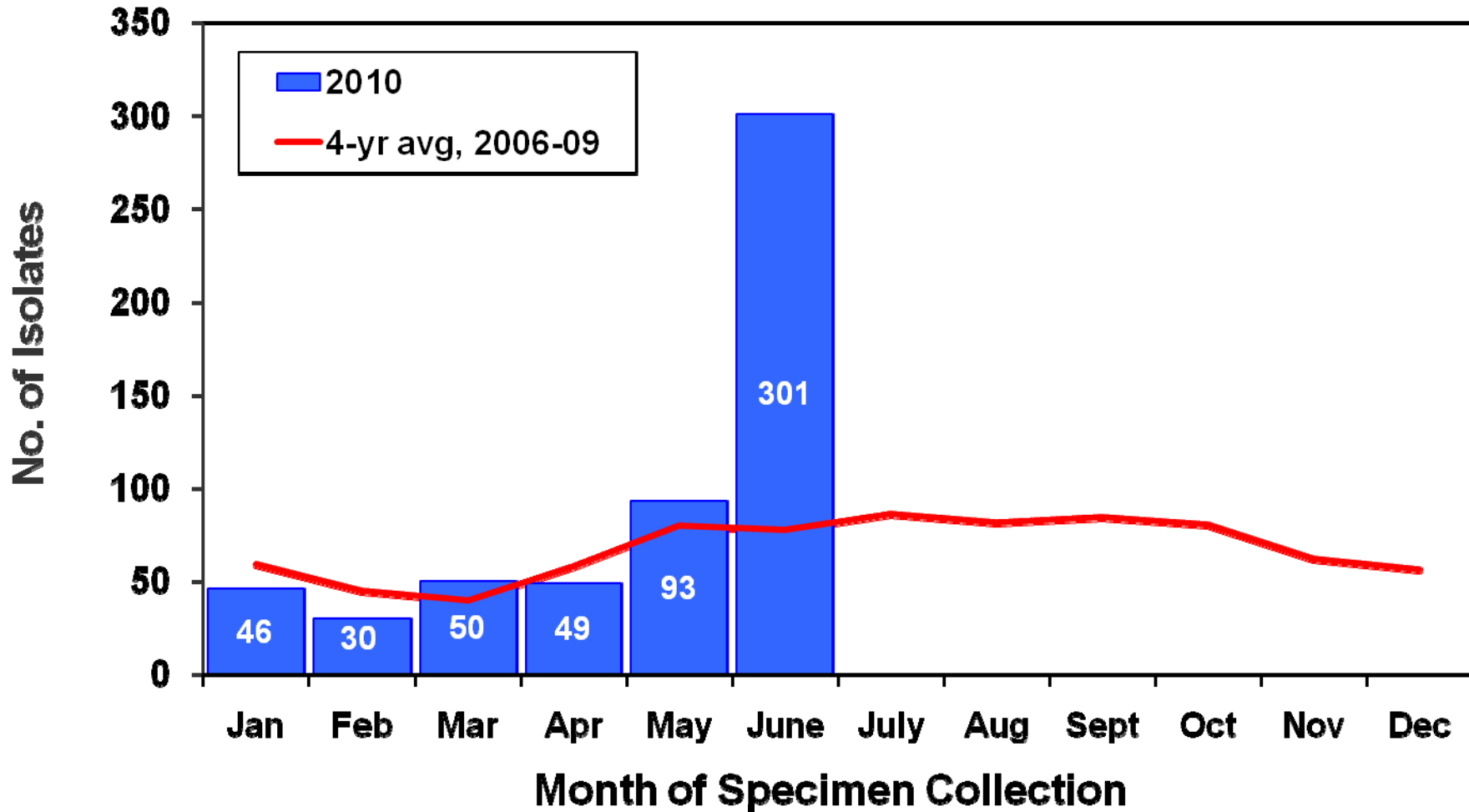
- CA population: 37 million
- 61 local health jurisdictions (LHJs)
- CDPH involved if multiple jurisdictions involved, media interest, or if consultation requested
- 5 PH labs certified to conduct PFGE



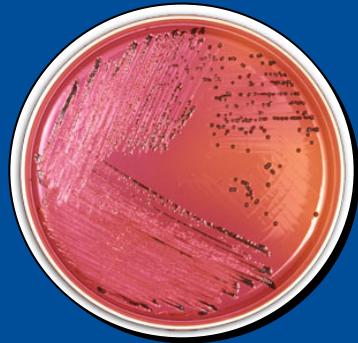
Approximately 5000 salmonellosis cases reported annually

- Majority sporadic cases
- Most follow up done by LHJs

Salmonella Enteritidis Isolates received
by CDPH Microbial Diseases Laboratory
by Month of Specimen Collection, CA 2010 (N=1257)
(As of 1-21-11)



PFGE and PulseNet 101...



PFGE



PulseNet

JEGX01.0004

PFGE identifies the DNA fingerprint (strain)

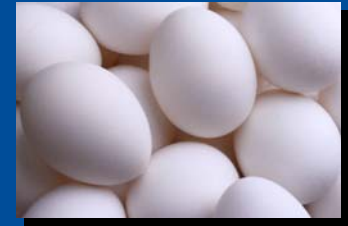
PulseNet

- Collects nationwide data
- Assigns PFGE pattern #s
- Identifies clusters

PFGE Cluster Investigations

- For clusters of rare *Salmonella* serotypes and rare PFGE patterns, we usually can assume a common source responsible for illnesses
- Collect/review initial case histories from LHDs
 - ▶ Illness onset dates
 - ▶ Demographics: gender, age, race/ethnicity
 - ▶ Geographic location
 - ▶ Exposures: food, animals, travel, events
- Conduct epi studies to test hypotheses

Salmonella Enteritidis (SE)



- Enteritidis most commonly reported *Salmonella* serotype causing human illness
 - ▶ Often associated with contaminated eggs and chicken
- Outbreak SE strain (PFGE pattern JEGX01.0004) most commonly reported *Salmonella* strain in CA and U.S.
 - ▶ CA increase started mid-May 2010
 - ▶ CA increase noted by state lab mid-June 2010

How would you like your eggs?

- Raw in shake/smoothie
- Sunny-side up
- Over easy
- Soft-boiled
- Hard-boiled
- Scrambled
- Omelets
- French toast
- Cookie dough, cake batter
- Custard
- Flan
- Mayonnaise
- Meringue pie
- Salad dressings
- Hollandaise sauce
- Béarnaise sauce
- Aioli sauce
- Carbonara sauce
- Chile rellenos
- Meatloaf, meat balls
- Crab cakes
- Casseroles
- Egg-white foam on cocktails
- Etc., etc, etc.

Our Approach for SE Investigation

Because the strain was so common...



- Epi data (demographics, restaurants, grocery stores, etc.) collected regionally and compared
 - ▶ San Francisco Bay area counties
 - ▶ Los Angeles County
 - ▶ Orange County
 - ▶ San Diego County
- Restaurant clusters of 2 or more investigated
 - ▶ Environmental health inspection
 - ▶ Trace back of eggs initiated

Some Initial Clues

- NC restaurant cluster (April 2010)
 - ▶ implicated meringue made from commercial pasteurized egg product
 - ▶ OB SE strain isolated from meringue
- Illnesses for two separate events held at common venue in Santa Clara County in late May

Two Outbreaks, One Venue

- Two events held at same Santa Clara County venue
 - ▶ May 28: University graduation dinner
 - ▶ May 29: High school senior prom
- Initially, 5 patients with OB strain of SE identified
 - ▶ 2 attended grad dinner
 - ▶ 2 attended prom
 - ▶ 1 food server who became ill after the second event
- Different types of menus
 - ▶ Grad dinner: sit down meal – salad, entrée, dessert
 - ▶ Prom: appetizers/snacks – pasta bar, chocolate dipping fountain

Common Menu Items

Comparison of menus for 2 events revealed only 3 common food items.

Romaine
lettuce hearts



Fresh
strawberries



Custard desserts



Mini fruit tartlets
(grad dinner)



Profiteroles
(prom)

Methods: Prom Case-Control Study

- Definitions
 - ▶ Case: Laboratory-confirmed SE or ≥ 1 days of diarrhea in the seven days following prom
 - ▶ Control: Individual who attended the prom but was not ill
- Randomized list of 634 seniors
- ID of ill persons by peers and faculty
- All interviewed by phone using a standardized questionnaire based on menu

Results: Prom Case-Control Study

- 81 attendees interviewed
- Analysis limited to persons who ate at least one item at the prom
 - ▶ 15 cases
 - ▶ 32 controls
- Profiterole only significant item
 - ▶ odds ratio = 12.0; 95% CI = 2.7–53.6



Note: Cohort study conducted for university graduation dinner; however, results were uninterpretable.

Custard



- Custard and desserts prepared by off-site bakery
- Profiteroles and mini fruit tartlets ordered for total of 1000+ people for two events
- Custard preparation and delivery (both desserts)
 - ▶ Pasteurized sugared egg product usually used
 - ▶ Shell eggs used when not enough pasteurized product
 - ▶ Eggs combined with milk, sugar, and vanilla and boiled for 5 minutes – probe thermometer not used to test temp
 - ▶ Prepared on May 27, delivered unrefrigerated May 28 (2 am)
- Shell eggs traced back to **Wright County Egg**

San Diego County Clusters

- 3 restaurants reported as exposures by 2 or more patients; several had egg dishes
- Environmental health investigators inspected restaurants to determine source of eggs at time of exposures
 - ▶ Pictures taken of egg boxes on-site at time of investigation
- Restaurants initially appeared to have different egg sources

Don't judge an egg by its carton!



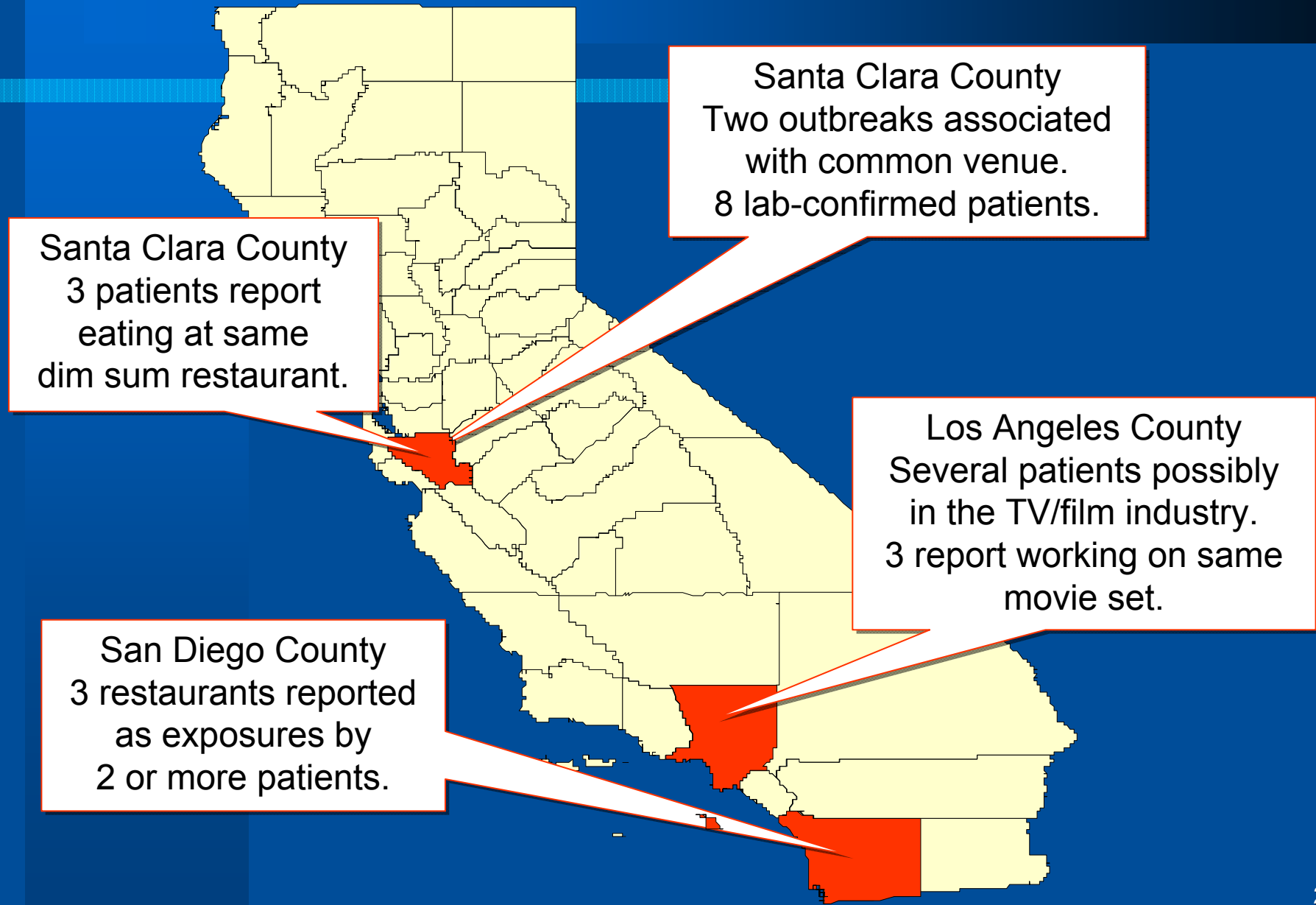
Restaurant	Egg Supplier/Distributor	Plant
1	Egg Company A Los Angeles, CA dist. by Distributor E	P 1946 → Quality Egg LLC Site 2
2	Egg Company B packed by Quality Egg LLC dist. by Distributor F	P 1943 → Quality Egg LLC Site 3
3	Egg Company C from Distributor G Lakeside, CA	P 1026 → Quality Egg Environ Division
	Egg Company D from Wright County Egg #1 dist. by Distributor H College Point, NY	P 1720 → Quality Egg LLC Site 1

Quality Egg LLC does business as Wright County Egg

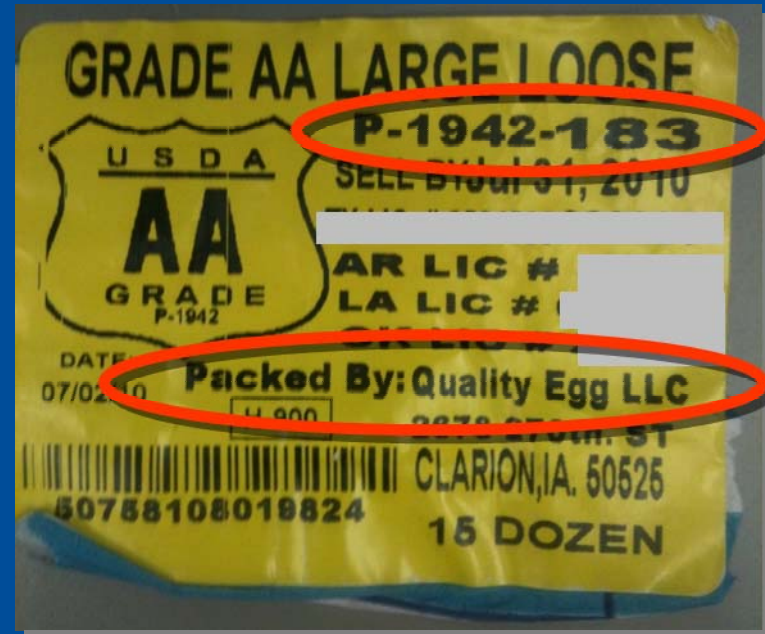
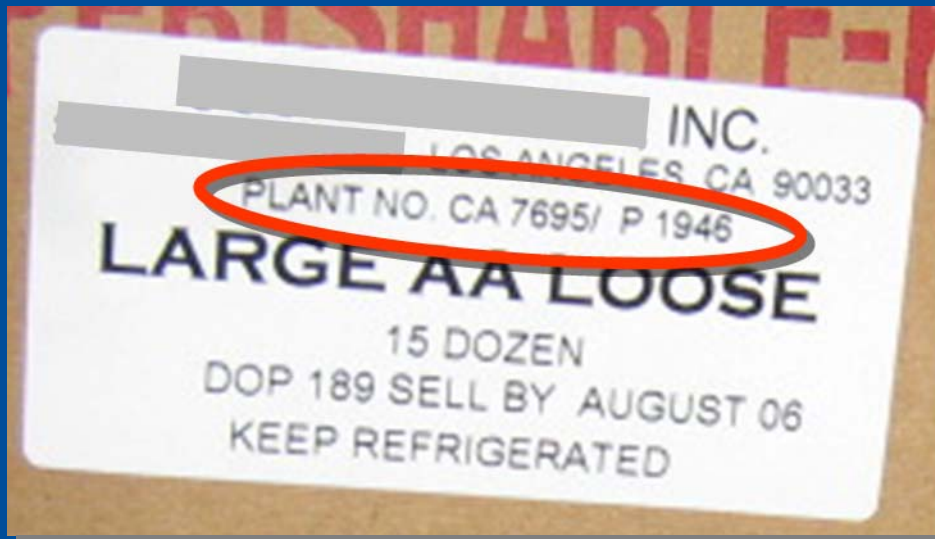
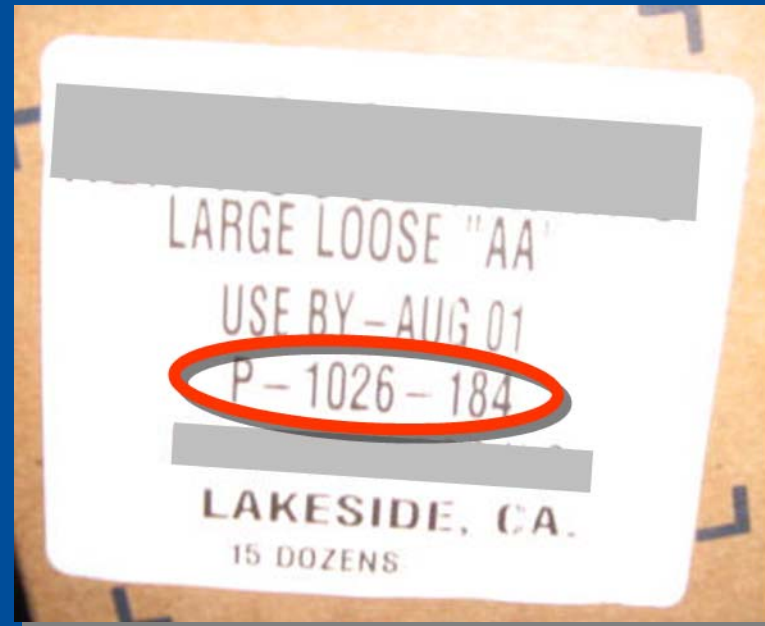
Los Angeles County Cluster

- Several patients that possibly worked in the entertainment industry identified
 - ▶ 3 reported working on the same movie
- Catering truck on-site at filming locale
 - ▶ Omelet bar
 - ▶ Eggs
- Catering company purchased eggs from Distributor J
- Distributor J reported that Wright County Eggs was their supplier

CA Clusters ...



The Teltale Labels



Photos courtesy of Brad Richardson (San Diego County Env. Health)

CA Pieces Fall into Place



- On July 29, 5 facilities linked to Wright County Egg (WCE) in Iowa; WCE eggs source of eggs during exposures or on-site at time of inspection
 - ▶ Bakery assoc/w prom and graduation dinner
 - ▶ Dim sum restaurant
 - ▶ 3 San Diego County restaurants
- On July 30, Los Angeles County confirmed that caterer for movie set also used WCE eggs

July 30, 2010: preliminary trace back of shell eggs at **6 of 6** facilities associated with CA clusters linked to Wright County Egg.

Egg Recall Timeline

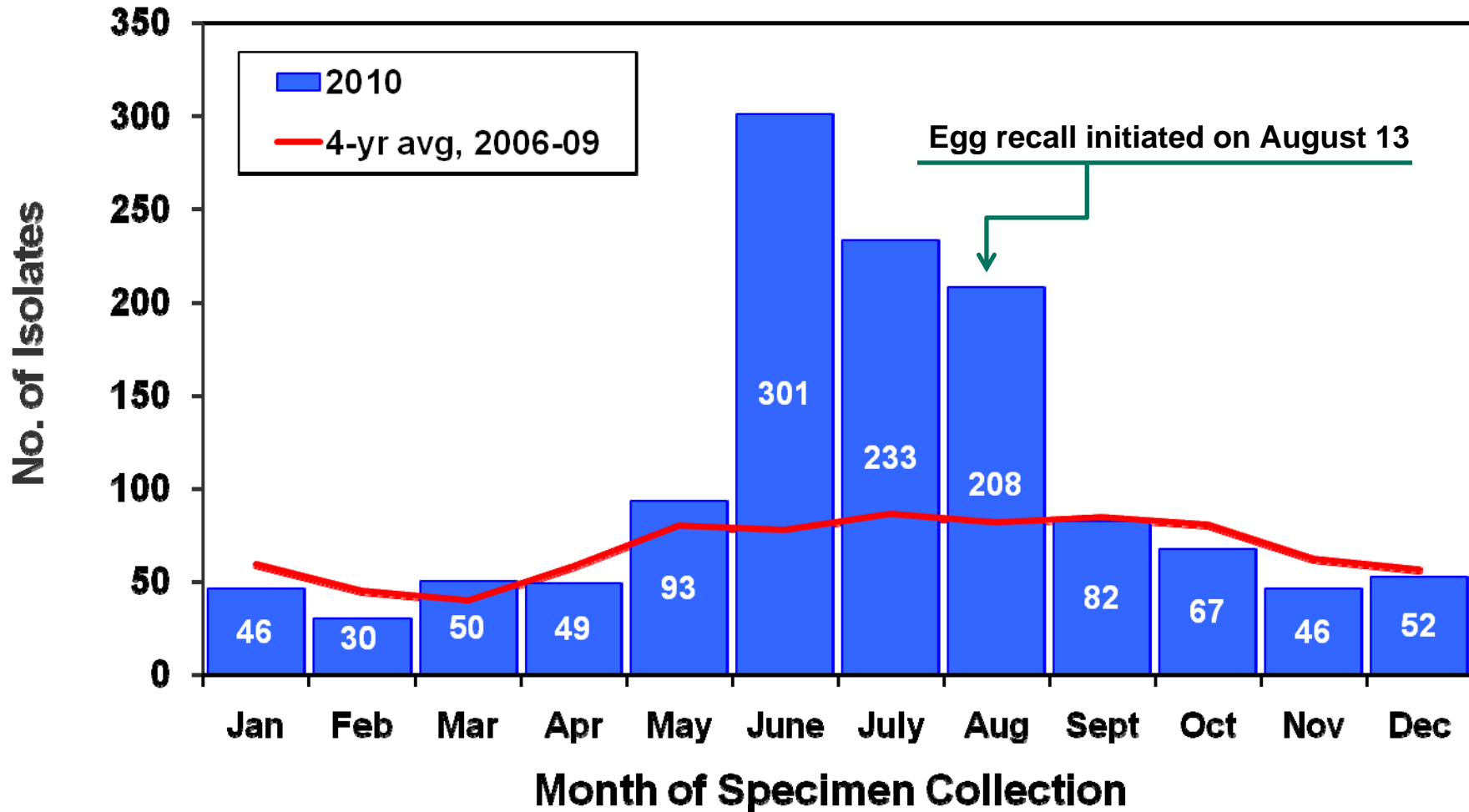
- July 30 CA discusses findings with CDC, FDA, and USDA
- August 4 Minnesota identifies WCE as source of eggs (used in hollandaise sauce) assoc/w restaurant cluster
- August 6 Colorado identifies WCE as source of eggs (used in rattlesnake cakes) assoc/w restaurant cluster
- August 9 FDA contacts WCE about findings
- August 13 WCE initiates voluntary egg recall
- August 20 Hillandale Farms initiates voluntary egg recall

Egg Traceback & Recall

- Shell eggs from Wright County Egg were sold to distributors and wholesalers in 22 states and Mexico, who then distributed the shell eggs further throughout the country
- Approximately 44 brand names implicated

~ 550 million eggs recalled
by Wright County Egg and Hillandale Farms

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FDA Observations at WCE

- Failure to prevent stray poultry, wild birds, cats and other animals from entering poultry houses



- Outside access doors to manure pits were pushed out by the weight of manure which was piled in some cases 4 to 8 feet high

FDA Environmental Sampling

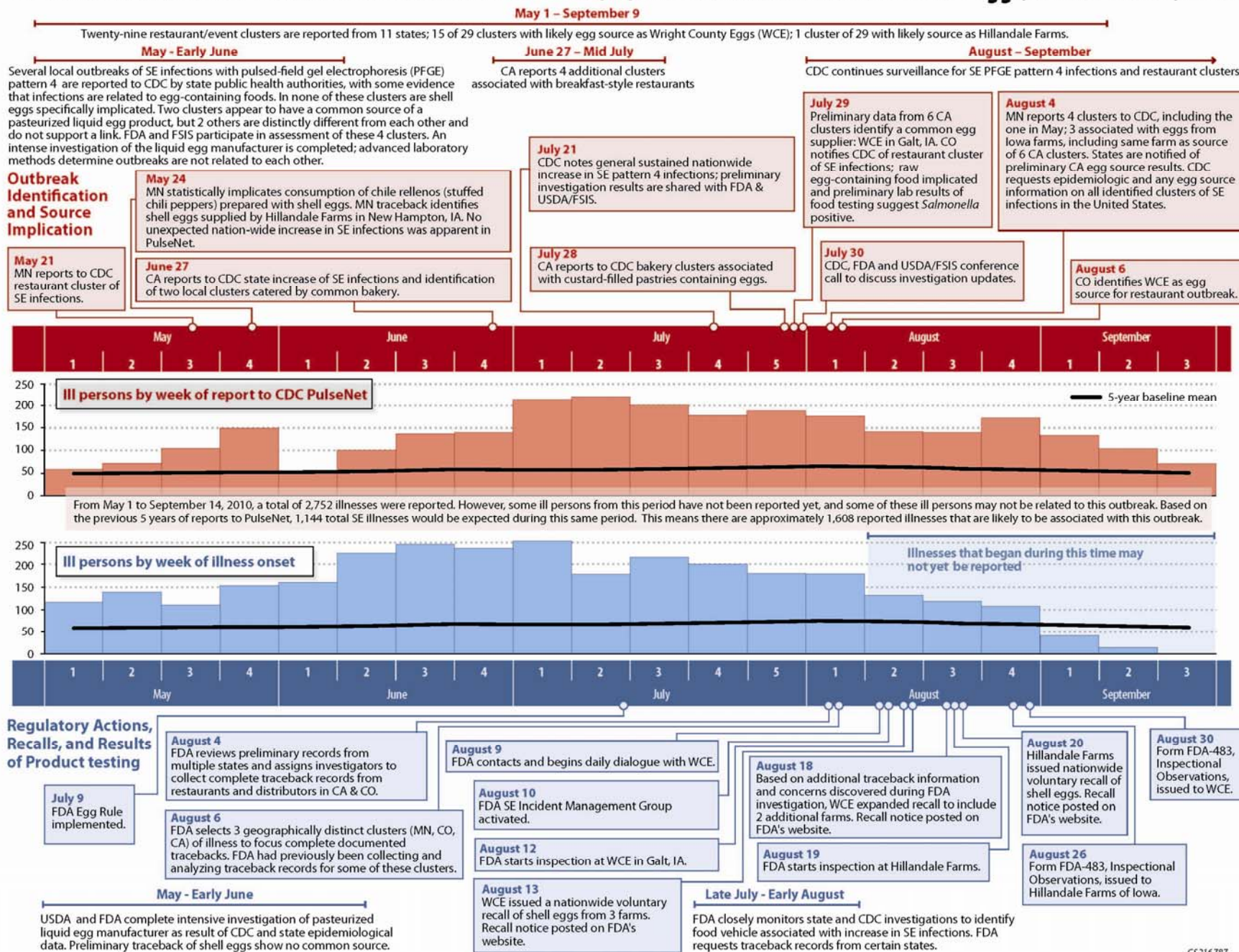
~600 environmental samples collected from WCE and Hillandale Farms of Iowa. 11 samples test positive for OB strain:

- Environmental swabs from manure, walkways, equipment, and other surfaces at WCE
- Samples from WCE feed mill
 - ▶ Finished feed provided to pullets raised at WCE facilities in IA. Pullets distributed to all premises at WCE and Hillandale Farms in IA.
- Sample from egg water wash at packing facility at Hillandale Farms

Who is Involved?

	Local	State (CDPH)	Federal
Communicable Disease	CD Control PHN Epidemiologists	Infectious Diseases Branch	CDC Enteric Diseases Epi Branch
Environmental Health	EHS	FDB CDFA	FDA USDA
Laboratory	Local PHL	MDL, VRDL, FDLB	PulseNet CDC lab
Public Information	Local PIO and Health Educators	Office of Public Affairs	Office of Public Affairs

Timeline: Nationwide Outbreak of *Salmonella* Enteritidis (SE) Infections Associated with Shell Eggs, United States, 2010



Challenges

- Common strains/PFGE patterns are more challenging than rare strains – may appear to be “sporadic”.
- Lack of resources to do PFGE testing on all *Salmonella* cases in CA
- Timeliness of Serotyping and PFGE testing delays recognition of clusters
- Lack of standardized *Salmonella* case interviews; Some LHDs don't interview at all
- Statistical methods, case-control or cohort studies can't always be done or may be challenging
- Product or food samples often no longer available for testing, opened packages or labels gone
- Complex distribution system, relabeling of products
- Delays result in less availability of documentary evidence (receipts, invoices) needed by regulatory agencies

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 - ▶ Food and Drug Branch
 - ▶ Microbial Diseases Laboratory
- California Emerging Infections Program
- California Department of Food and Agriculture
- U.S. Centers for Disease Control and Prevention
- U.S. Food and Drug Administration