

Recent Recalls & Causes Emerging Pathogens

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Outline



- Overview risks and primary intervention strategies
- Why are we still having problems?
- What are the next pathogens of concern?
- Review of recalls and outbreaks
- Lessons learned from investigations

Top 10 Pathogen: Food Combinations

Economic burden & quality adjusted life years

1. *Campylobacter* in poultry
2. *Toxoplasma* in pork
3. *Listeria* in deli meats
4. *Salmonella* in poultry
5. *Listeria* in dairy products
6. *Salmonella* in complex foods
7. *Norovirus* in complex foods
8. *Salmonella* in produce
9. *Toxoplasma* in beef
10. *Salmonella* in eggs

Pathogens: General Concepts

- Raw foods can contain pathogens
- Pathogens generally found at low levels
- Can survive/grow in adverse conditions
- Infectious dose varies
 - *Listeria* unknown, likely > 1, 000 cells
 - *E. coli* O157:H7, 10 to 100 cells
- Survival of low infectious dose (Gram -) pathogens significant issue
 - Requires a kill step
- Toxin formation requires growth
 - *S. aureus*, *B. cereus*, *C. botulinum*

Primary intervention strategies

- Prevent contamination, recontamination
 - GAPs
 - GMPs, cleaning, sanitation
 - Employee hygiene and employee health
- Kill step
 - Cook, pasteurize, irradiate, HPP
 - Chemical inactivation (rinses)
 - Manufacturer, food service, consumer
- Prevent growth
 - Proper temperature control
 - Use of antimicrobials in formulation

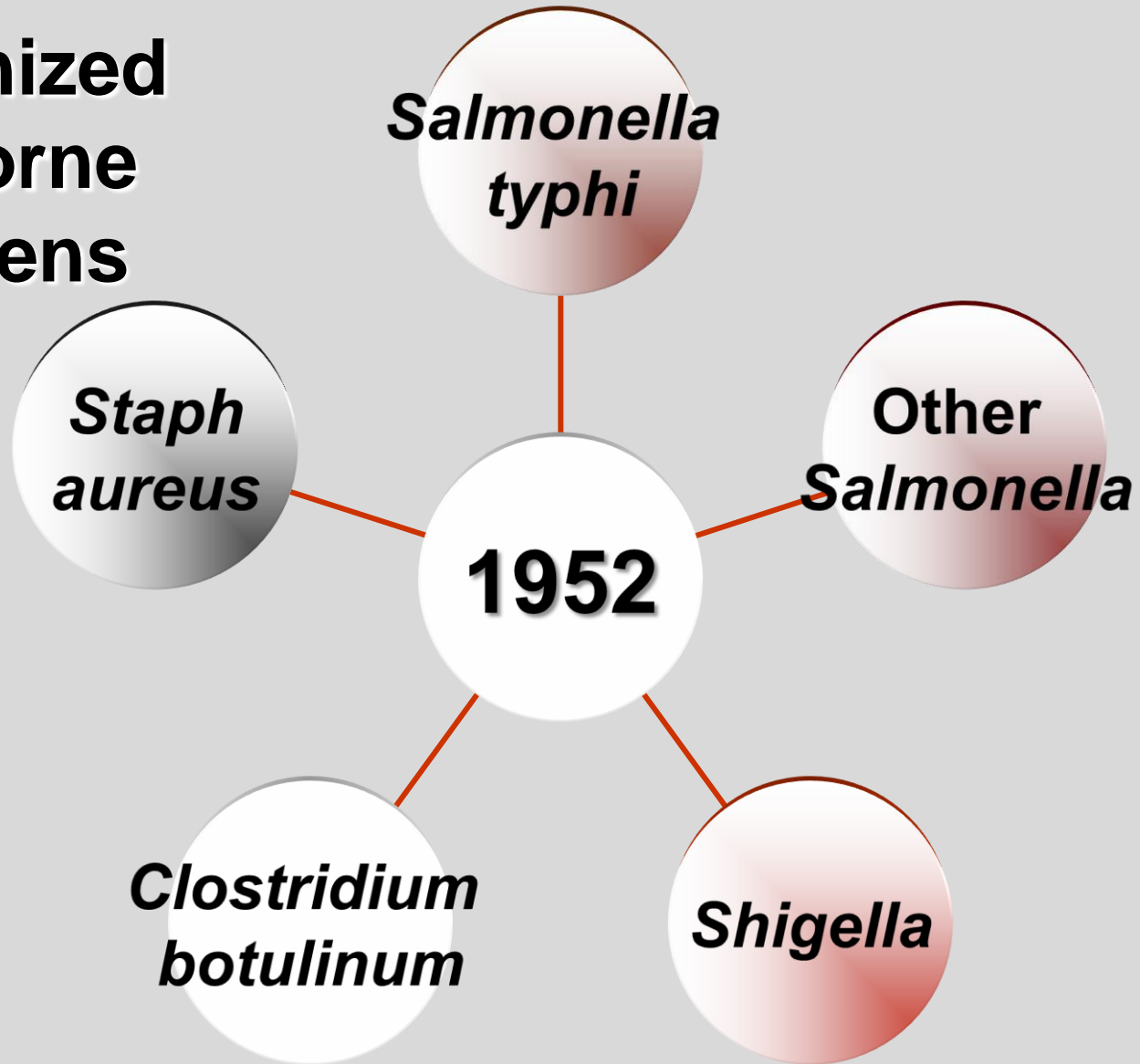
If intervention is straight forward, why do we still have problems?

- Failure to understand that pathogens are evolving
 - Are there other *E. coli* serotypes other than O157 which can cause illness?
- Failure to consider that raw foods/ingredients may be contaminated with pathogens
 - How can we prevent contamination of plants in the field
 - How do we reduce pathogen load on raw vegetables before packaging or use in salads?
- Failure to prevent recontamination
 - Is the processing equipment and facility of good sanitary design? Is the environmental control program sufficient to find and eliminate contamination such as *Listeria* and *Salmonella*

Why do we still have problems?

- Failure to comply with basic methods to control bacterial pathogens
 - Does manufacturing meet all CCPs (or are they just a strong suggestion?)
- Lack of understanding where the responsibility for food safety lies
 - Is the process too dependent on end user? Is it obvious to the user that an additional kill or control step is necessary?
- Failure to recognize patterns of issues (early warning) and develop new intervention
 - Has there ever been a problem with a similar product in the past? Why? Should we be concerned with NFDM because an outbreak of Salmonella occurred in 1969?

Recognized Foodborne Pathogens



Recognized since 1980

- Bacteria
 - *E. coli* O157:H7
 - *Listeria monocytogenes*
 - *Campylobacter*
 - *Salmonella* Enteritidis
 - *Salmonella* Typhimurium DT104
 - *Vibrio*, *Yersinia*
- Viruses: Norovirus, Hepatitis A
- Parasites
- Algae

Factors Contributing to Emergence

Recognition and detection

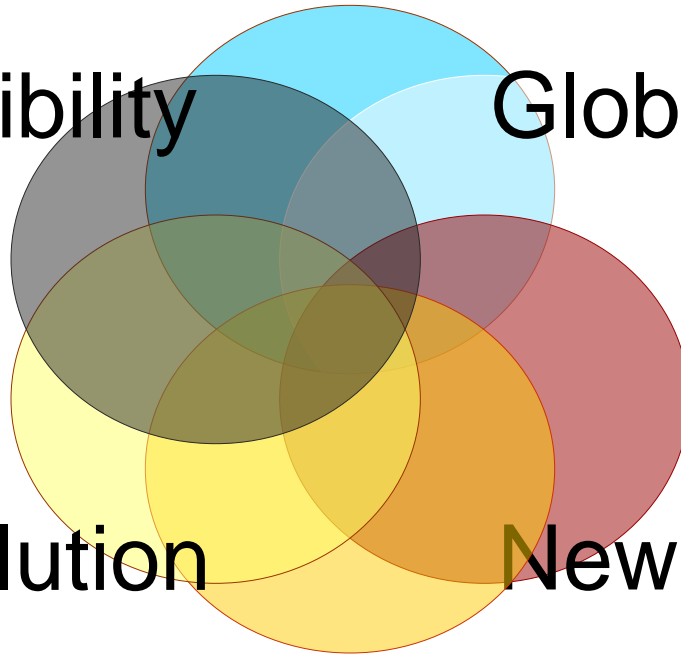
Host susceptibility

Global food supply

Microbial evolution

New food vehicles

Processing and distribution



Emerging Pathogens: 2011

- Real: Non-O157 shiga-toxin producing *E. coli*
 - STEC O26, O111, O103, O45, O121 and O145
 - O103 and O157 greatest survival at low a_w
 - Flour used in cookie dough
 - O45 and O121 most tolerant to low pH
 - *What foods should we be concerned?*
 - O104: newly recognized serotype

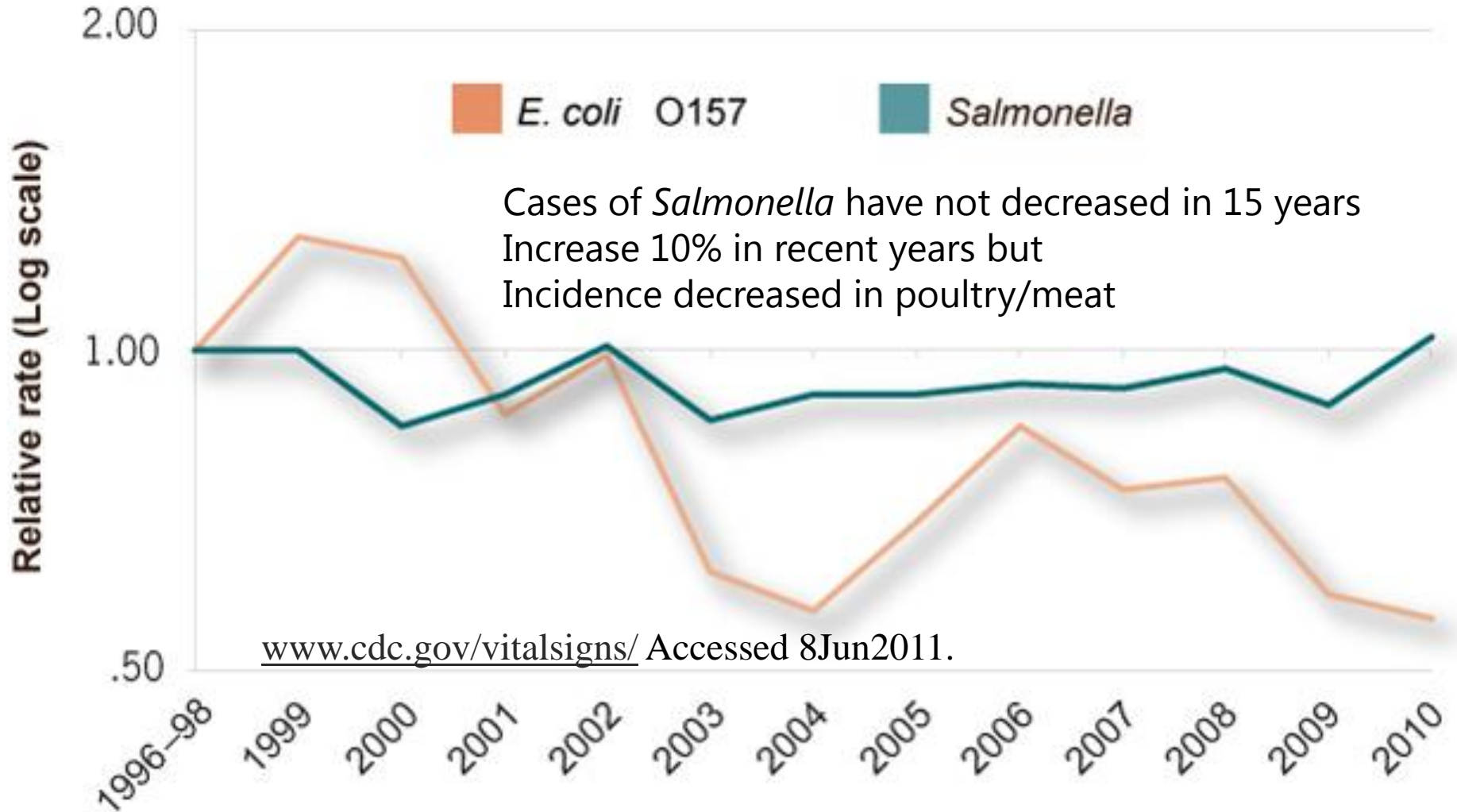
Emerging Pathogens: 2011

- Possible: *Clostridium difficile*
- Opportunistic pathogen; typically community transmission
- Increasing prevalence of O27/NAP1 strain
 - Hospitals, outbreaks, severe disease
 - Food: 20%+ retail ground meat; raw vegetables
- Animal reservoirs via food are possible sources
 - *Should high risk individuals only eat commercially sterile foods?*

Emerging Pathogens: 2011

- Possible: MRSA
 - Methicillin resistant *Staphylococcus aureus*
- Typically community transmission
- Could be opportunistic infection
 - staphylococcal enterocolitis
- Found in 3-10% of raw meat and milk samples
- Not readily transferred from meat to handlers
- Killed by typically cooking/pasteurization
- Not clear if have unusual growth characteristics or resistance to sanitizers

Re-Emerging: *Salmonella*



New Food Vehicles of Transmission

- ❑ Foods consumed without a kill step
- ❑ Low moisture foods
 - Cereal, peanut butter, flour, chocolate
 - Spices, tahini, vegetable seasoning
 - Infant formula
 - Raw almonds, hazelnuts, walnuts
 - Pet foods & treats
- ❑ Whole shell eggs
- ❑ Fresh produce
 - Tomatoes, green onions, snow peas
 - Leafy greens, lettuce, spinach
 - Sprouts
 - Basil, parsley, cilantro
 - Melons, strawberries, raspberries, juice and cider



Recent recalls and outbreaks

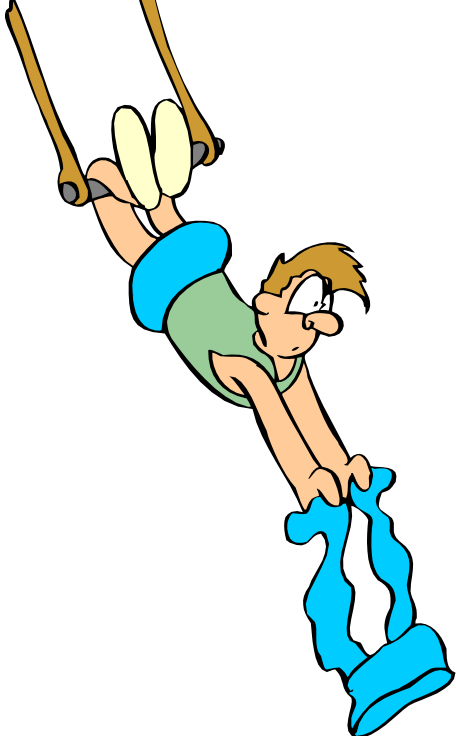
Food	Reason	Illness
Thickening Gel, 2011	Failure to file process	None Reported
Pig ear dog chews, 2010-11	<i>Salmonella</i>	None Reported
Trail mix, 2011	Allergen (milk)	None Reported
Pastrami, roast beef, 2011	<i>L. monocytogenes</i>	None confirmed
Cheese (Swiss-like), 2011	<i>L. monocytogenes</i>	None Reported
Unknown, 2011	<i>L. monocytogenes</i>	CO, 2 deaths
Head Cheese, 2010	<i>L. monocytogenes</i>	14 cases, 2 deaths

Salmonella outbreaks 2010-11



Food	Location	Illness
Salad	IL, Single restaurant	15 cases
Turkey burgers	Multistate, home	12 cases
Zeppoles (bakery); pastry cream	RI	79 cases, 30 hospitalized, 2 deaths
Sprouts	Gourmet sandwich shop, 16 states +DC	140 cases
Black pepper used on dry, fermented sausage	44 states	233 illnesses, recall 1.4 million lb salami products
Backyard poultry, single hatchery, 2011	11 states, 25 cases	





Most outbreaks are the result of a series of mistakes...

- Poor sanitation practices
- Poor process control
- Poor facility and equipment design & inadequate maintenance
- Poor ingredient control and handling
- Lack of GMPs, GAPs

Canned Chili Sauce, 2007

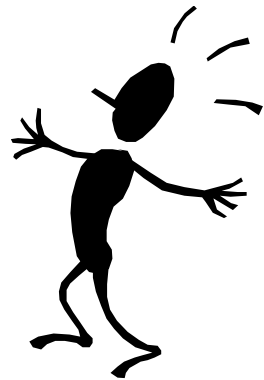


- ❑ Foodborne botulism, 8 cases including 1 death
- ❑ Inadequate thermal processing, plant poorly maintained, spores in cooling water
- ❑ Recall 90 additional items, 10MM lb product
- ❑ Should we be surprised?
 - 1973 Low acid canned food regulations

Raw milk gouda, 2010



- *E. coli* O157:H7; 5 states, 38 cases
 - Investigation also isolated *L. monocytogenes* but no illness; recall/ seizure
- Should we be surprised?
 - 2002 Gouda cheese made from unpasteurized milk, aged 104 days at time of outbreak
 - Calgary, Canada; 11 illness; 1 hospitalization
 - Cheese O157+; 1 sample 40 *E. coli* / gram;
 - Post-outbreak environmental, well water, raw milk samples negative
- 60 days aging ok after WWII; not after O157
 - Several lab studies confirm survival >60 days



Salmonella peanut products, 2008-09

- 714 cases, 46 states
- 3,500 products, 200 companies affected
- Contributing factors
 - Open gaps in the air conditioner intakes located on the roof of the facility.
 - Rainwater leaking into gaps → into production packaging room and totes of finished product and a packaging line located directly underneath the gaps.
 - Ignored positive test results; retested to negative
 - Failure to audit incoming ingredients /suppliers





STEC *E. coli* O104:H4, 2011

- 6/9/11: >2,743 cases, 722 HUS, 26 deaths EU
 - Extremely toxigenic; 30% kidney failure, 10X normal rate
 - Unknown infectious dose; most STEC low dose
- Suspect vehicle: fresh vegetables
 - No “smoking gun” i.e. strain not isolated from foods or environment
 - Implicated lots may not be available
 - Likely candidate: sprouts, alfalfa, mung bean, radish, arugula, bean produced by single farm N. Germany
 - Contamination of seeds, proliferate during sprouting process, long survival; multiple outbreaks yearly in US
 - Also considered: prewashed lettuce
 - Cucumbers, tomato

Lessons Learned

- GMPs, GAPs, and adhering to HACCP are not optional
 - Failure to use validated processes/formulations can allow survival and growth of pathogens
- Environmental control essential
 - Know how, where, # samples
 - Eliminate resident pathogens: same serotype/PFGE
 - *Salmonella* cereal outbreak: 10 years
 - *Listeria* RTE meat outbreak: 12 years

Lessons Learned

- Control water
 - Leaky roofs, pipes, drains, cross-contamination
- Foods which inhibit growth may also need a kill step
- Failure to monitor water, ingredients, finished products can miss regular contamination
 - But cannot make product safe by finished product testing
- A positive is a positive and you need to respond accordingly

Summary

- ❑ Assume low levels of pathogens are present in raw ingredients/environment
- ❑ Consider all sources of contamination
- ❑ Reduce levels of contamination by proper sanitation/heat treatment
- ❑ Prevent post-processing contamination
- ❑ Assure pathogens cannot grow by controlling formulation and/or storage temperatures
- ❑ Be proactive. Don't wait for problems to develop.