



Understanding the Root Cause of an Outbreak

E. Coli Workbook

Identifying contributing
factors and environmental antecedents



Integrated Food Safety
Centers of Excellence



Outbreak Information

Outbreak Identification:

On October 10th, the health department identified three isolates of *E. coli* O157:H7. Routine interviews of the three cases revealed that all had eaten food from the same restaurant between the dates of September 16th and September 25th. Upon this notification, environmental health was contacted, and an outbreak investigation was initiated.

It was discovered that the restaurant had not opened yet. The restaurant was hosting some soft openings to pilot their menu and acclimate the staff to the establishment's operations. The restaurant serves Mediterranean dishes such as Greek salads, hummus plates, gyros (beef, chicken and falafel), and spanakopita.

Epi Findings:

Cases were identified through routine laboratory surveillance and interviews with restaurant patrons identified through credit card receipts and a case-control study was conducted. Confirmed cases were defined as a person who tested positive for STEC at a clinical laboratory after eating at the restaurant. Probable cases were defined as a person with diarrhea (≥ 3 loose stools in a 24-hour period) that was either bloody or at least 3 days in duration after eating at the restaurant.

Interviews were conducted with 38 patrons. Eleven cases, eight laboratory confirmed and three probable, were identified. Meal dates ranged from September 12th through September 30th. Four patrons were hospitalized due to their illness. The median incubation period was 3 days (range, 2 to 16 days). The median duration of illness was 7 days (range, 2 to 25 days).

Case-control findings found that consuming any falafel was significantly associated with illness.



Resources

CIFOR OUE Agent List

Agent Name	Median Incubation Period	Primary Signs and Symptoms	Notable Exposures
Enterhemorrhagic <i>E.coli</i> (EHEC) (including Shiga-toxin producing <i>E. coli</i> (STEC) and Verotoxin producing <i>E. coli</i> (VTEC))	3-4 days (1-10 days)	Diarrhea (often bloody), abdominal cramps, vomiting, hemolytic-uremic syndrome (HUS)	Consumption of raw milk; contact with cattle/ ruminants; undercooked ground beef; leafy greens

IAFP Key F. Situations that likely contributed to outbreaks of foodborne diseases when mixed foods were implicated as vehicles

Mixed foods		Farm/Field			Processing							Retail Store/Food Service/Home																							
		Contamination			Contamination Issues							Holding/Storage				Processing				Contamination				Holding/Storage				Processing							
<div>✖ = Principal Factor to Consider ✔ = Factor to Consider ◢ = Potential Factor to Consider ● = Source of contamination, but likely to be destroyed during later processing T = Toxin Survives Heat Processes</div>		Colonized/Infected/Toxicogenic Animals	Environment/ Climate	Animal Feces/Manure	Soil/Grass/Mud	Worker	Cross contamination	During Cooling	Environment	Improper Cleaning of Equipment	Manipulation/Spread	Use of Contaminated Water	Worker	Improper Hot Holding	Inadequate Refrigeration	Prolonged storage	Room/Outdoor Temperature Holding	Heat Process Failure	Improper Cooling	Improper Water Activity (a _w)	Inadequate Reheating	Organism/Toxin Survives Process	Cross contamination	Improper Cleaning of Equipment	Worker/Person	Improper Hot Holding	Inadequate Refrigeration	Prolonged storage	Room/Outdoor Temperature Holding	Heat Process Failure	Improper Cooling	Inadequate Reheating	Organism/Toxin Survives Process		
		MIXED SALADS, i.e., Mixes of proteins, grains and/or vegetables with most ingredients cooked, e.g., Chicken salad, Egg salad, Potato salad, Tuna salad, Pasta salad, Salsa with cooked ingredients																																	
		Bacteria																																	
		Some Heated Ingredients	Campylobacter						◢		✔						✔		✔	✖	◢				✖				✔			✖			
			Escherichia coli STEC\ VTEC						✔	✔	✔	✔					✔		✔	✖	◢				✔			◢				✔			
Salmonella							✖		✔	✔					✔		✔	✖	✔				✖			◢				✖			✔		
Shigella																✔		✔	◢	✔						◢				✖					
		Staphylococcus aureus					◢					✖	✖		✔		✔	◢	✔			✔	◢		✖	◢				✖			✔		
Virus																																			
Hepatitis A Virus												✖												✖											
Norovirus							◢	✔					✖											◢		✖									



Exercise 1

Use the outbreak information and resources to answer below questions for site visit.

What practices would investigators want to observe?

What records would investigators want to review?

What might be some questions investigators ask the manager and/or food worker?





Outbreak Information

Environmental Findings:

- Inspectors visited the restaurant on October 10th to conduct an environmental assessment which included evaluating food preparation and handling procedures, checking the employee illness log, interviewing employees, and gathering patron credit card receipts). (*THINK: What are possible ways E.coli could contaminate a food item?*)
- During the environmental assessment, inspectors observed that meat prep and vegetable prep were done in separate areas. However, employees reported that they used the same grinder for raw beef, raw lamb, and the garbanzo beans used to make falafel. (*THINK: Why is the same grinder being used to prep beans and raw beef?*)
- They reported that the grinder parts were cleaned in the 3-compartment sink, and then washed and sanitized again in the dishwashing machine. Upon observation of the grinder cleaning process, all food-contact parts of the grinder were removable. The cleaning process appeared to be effective, as there was no visible evidence of food residue in or on any of the grinder parts. (*THINK: How often is the grinder being cleaned and sanitized?*)
- After asking about the falafel food flow, inspectors learn that the grinder is first used for raw meat because it is used in more dishes and requires longer prep time. The food workers refer to a procedural handbook when asked about how the grinder is cleaned and sanitized between uses. (*THINK: What is the food safety training/certification for food workers at this establishment? Do food workers follow the procedural handbook?*)
- Inspectors also observed falafel cooking. The finished cook temperature was measured at 198°F and was still rising due to heat gain. However, employees didn't routinely take temperature of the falafel when cooked. (*THINK: Why don't you take routine temperatures of cooked product?*)



Exercise 2A

Determine follow-up questions and think about contributing factor and environmental antecedent categories.

Based on the *think* questions from the environmental findings, what are some follow-up questions you would ask manager and/or food worker?

Which category(ies) would the contributing factor(s) fall into? (Contamination? Proliferation? Survival?)

Which category(ies) would the environmental antecedents fall into? (People? Process? Equipment? Food? Economics?)





Exercise 2B

Determine contributing factors and environmental antecedents.

What contributing factor(s) do you suspect?

What environmental antecedent(s) do you suspect? Choose the top 3.





Resource

Short-term	
Embargo/discard/destroy product	
Require physical facility or equipment change	
Change ingredient (remove or replace)	
Change process (correct or replace)	
On-the-job training	
Fines/penalties	
Closure	
Limit menu/restrict food	

Long-term	
Formal training/certification	
Policy change (written or documented)	
Risk control plans	
Increase inspections	
Change supplier	
Require consultant or 3 rd party audit	
Change product (remove or replace)	



Exercise 3

What control measures would you implement?

Based on contributing factors and environmental antecedents you identified, what might be some short-term and long-term corrective actions you would put in place to ensure this wouldn't happen again?

How could findings from this investigation be used to influence food safety at a community or national level?



Contributing Factor Video



Environmental
Antecedent Resources