Illness at the Inn

A Foodborne Illness Outbreak Investigation Case Study

Developed by the

Colorado Integrated Food Safety Center of Excellence

PARTICIPANT

Colorado Integrated Food Safety CENTER OF EXCELLENCE

Integrated Food Safety Centers of Excellence

Learning Objectives

After completing this case study, participants should be able to:

- Explain what constitutes a foodborne illness outbreak.
- Describe the steps in a foodborne illness outbreak investigation.
- Develop interview questions for potential cases.
- Establish an outbreak case definition.
- Create and interpret an epidemic curve.
- Describe the types of epidemiological studies used during an outbreak investigation.
- Calculate and interpret relative risks.
- Describe the information needed to conduct a traceback investigation.

This case study was developed by the Colorado Integrated Food Safety Center of Excellence. For additional information, or to provide feedback, visit http://www.COFoodSafety.org

PART A: BEGINNING THE INVESTIGATION

Initial Complaint Call

You work as an enteric disease epidemiologist at Tri-County Health Department. On Thursday, March 27th, you receive a phone call from Tami at Denver Hospital. She informs you that the previous day, a 42-year-old woman came into the hospital with diarrhea, fever, and abdominal cramps. The patient said that she knew of two other people experiencing similar symptoms after attending a wedding.

Question 1: You interview the case-patient and two of her companions who reported experiencing similar symptoms. What questions would you ask these people?

You interview the three ill people by telephone on March 28th. All reported experiencing similar symptoms of diarrhea, fever, and abdominal cramps. You learn that they all attended a wedding reception at the Hyperion Hotel on March 24th. All of them stayed at the hotel for different lengths of time between March 21st and March 28th. They said they knew other ill people who had attended the wedding and agreed to submit a stool sample for testing.

The Hyperion Hotel is a modest, boutique 15-room hotel with a small event space, a restaurant, and a pool/game room. The popular hotel restaurant serves a daily breakfast, lunch, and dinner. Breakfast items are available from a menu as well as a daily breakfast buffet. Full service banquet and reception facilities are available including food preparation.

Question 2: Is this an outbreak? Why or why not?

All three cases reported similar symptoms and a common exposure (i.e., attending a wedding reception at the Hyperion Hotel). In addition, they all said they knew of other ill people who had attended the wedding. Based on this information, you decide to initiate an outbreak investigation. As a first step, you work on identifying and interviewing additional cases.

Question 3: How would you identify additional cases?

PART B: EPIDEMIOLOGIC STUDY

The bride and groom provide you with their wedding guest list. The Hyperion Hotel also agrees to provide you with a roster of people who stayed at the hotel during the week of March 21st to March 28th, including their email address or telephone number.

Hypothesis generating interviews of hotel and wedding guests were conducted using a brief questionnaire with open-ended questions. Questions were designed to determine if illness occurred and to generate hypotheses about potential modes of transmission, including food vehicles. Over the next two days, your team successfully contacts 23 hotel and wedding guests who experienced a diarrheal illness. Illness onset dates ranged from March 23rd to March 28th. All of those who reported symptoms stayed overnight at the hotel. Ill people included non-wedding guests.

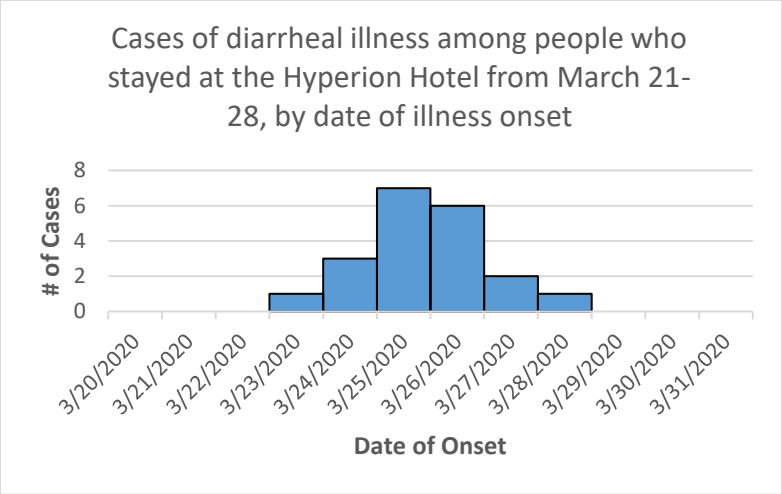
Question 4: Based on the information so far, develop a case definition for this outbreak.

Your team defines a case as “a person having diarrhea (at least 3 or more loose stools, bloody or non-bloody, in 24 hours) and one other clinical symptom (such as fever or abdominal cramps), after staying at the Hyperion Hotel between March 21st and March 28th.”

Stool samples from the initial three patients come back from the state public health laboratory positive for *Shigella sonnei*. *Shigella sonnei* is a bacterial pathogen. Symptoms which include watery or bloody diarrhea, fever, and abdominal pain typically start 1-2 days after exposure and usually last 5-7 days in people with healthy immune systems. *Shigella* is very infectious and only a small number of bacteria (10-200 organisms) are required to cause infection. *Shigella* can be spread by food, water, or person-to-person contact (CDC, 2016). *Shigella* sonnei outbreaks occur commonly in day care settings due to person-to-person transmission. Foodborne outbreaks are less common.

Question 5: Using the line list in Appendix A, apply the outbreak case definition and create an epidemic curve for this outbreak. What pattern of spread does the epidemic curve suggest?

Twenty people from the linelist meet the outbreak case definition. The number of illnesses rises rapidly to a peak and fall off gradually, with a majority of cases within one incubation period. This pattern suggests a point source outbreak, in which cases were exposed over a brief time to the same source.



You conduct a descriptive analysis of the activities cases reported doing while staying at the hotel. The most commonly reported activities and exposures are given below along with some demographic information.

Table 1: Activities that cases participated in while staying at the Hyperion Hotel (N=20)		
Activity	**N**	**%**
Swam in the pool	9	39%
Swam in the hot tub	6	30%
Ate at breakfast buffet	17	85%
Attended wedding reception	11	55%
Attended other hotel event	7	35%
Used fitness center	5	22%

Table 2: Case Demographics (N=20)	
# of females	11 (55%)
# of males	9 (45%)
Median age	52 years
Age Range	1-89 years

Question 6: After examining information on what the guests did during their stay at the Hyperion Hotel, what is your hypothesis about how the cases were exposed to *Shigella?*

Since 17 out of 20 cases reported eating an item at the breakfast buffet, you suspect that cases may have been exposed to a food item served at the hotel's buffet breakfast.

Question 7: What type of epidemiologic study should you conduct to investigate this outbreak? Why?

Given the hotel guests represent a well-defined group with easily available contact information, your team decides to conduct a cohort study. You and your team attempt to interview the 65 ill and well guests who stayed at the hotel between March 21st and March 28th using a questionnaire that assesses the onset of patients' symptoms and what foods/drinks they consumed while staying at the hotel. Wedding attendees who did not stay overnight at the hotel were considered "non-guests" and were not included in the cohort study. You and your team were able to contact 57 of the 65 hotel guests.

You collect information on what the ill guests and well guests ate:

Table 3: Food Items Consumed by Hyperion Hotel Guests between March 21-28

Item	Ill Guests Exposed	Well Guests Exposed	Risk Ratio	95% CI
Orange Juice	10	15	1.3	0.63-2.59
Skim Milk	11	20	?	?
Bacon	8	10	1.44	0.72-2.91
Sausage	6	10	1.1	0.51-2.35
Pancakes	15	20	1.9	0.79-4.46
Scrambled Eggs	17	21	2.8	0.95-8.49
Strawberries	17	22	2.6	0.88-7.80
Honeydew Melon	19	8	?	?
Total	20	37	-	-

Question 8: Use the information in the table provided to calculate the missing risk ratios and 95% confidence intervals for Honeydew Melon and Skim Milk and interpret the risk ratios. What foods may have been the source of this outbreak?

Hint: Here are the formulas to calculate relative risk and how to interpret relative risk:

Table 1: Calculating relative risks in a cohort study

Exposure (or risk factor)	Number of people	
	Ill persons	Well persons
Present	*a*	*b*
Absent	*c*	*d*
Total	*a+c*	*b+d*

Relative risk $\dfrac{\text{Incidence proportion in exposed}}{\text{Incidence proportion in unexposed}}$ $\dfrac{\frac{a}{a+b}}{\frac{c}{c+d}}$

Interpreting Relative Risks:

- Close to 1.0, the risk of disease is similar among people with or without exposure and the exposure is not associated with illness.
- Greater than 1.0, the risk of disease is higher among people exposed when compared to people unexposed and the exposure could be a risk factor.
- Less than 1.0, the risk of disease is lower among people exposed when compared to people unexposed and the exposure could be a “protective factor”.
- The magnitude of the risk ratio reflects the strength of association between eating food illness.

People who ate honeydew melon were significantly more likely to become ill than persons who did not have honeydew melon (RR: 21.1; 95% CI: 3.03, 147.3). Drinking skim milk was not significantly associated with illness (RR: 1.03; 95% CI: 0.5, 2.1). Honeydew had a relative risk of 21.1 and was the only food significantly associated with illness, indicating that honeydew melon may have been the source of the outbreak.

PART C: ENVIRONMENTAL ASSESSMENT AND TRACEBACK

Environmental health professionals on your team conducted an environmental assessment of the hotel restaurant. Full access to the facility, including the bar area, event space, restaurant, breakfast buffet, and restaurant kitchen was granted. Investigators were permitted to interact with the kitchen staff and the Chef. The kitchen staff were questioned regarding the preparation of fruit, specifically the honeydew melon.

Question 9: What questions would you ask the kitchen staff regarding the preparation of honeydew melon?

Two individuals in the kitchen prepare the melon. The protocol described by the primary person who cuts melon involves washing with cold water in the vegetable prep sink, peeling the rind, slicing, seed removal, and dicing. A kitchen supervisor indicated that he requires a dilute bleach wash prior to cutting the melons, but is unsure if this is performed when he is not present. Melon is stored in a clean pan and placed into the serving pan with tongs. Serving pans are placed on the buffet on ice. The pan is then stored in the walk-in cooler. If needed, the buffet is refilled from the refrigerated stored melon. There were conflicting reports about how many days the cut melon was used. Kitchen staff indicated that melon is cut up daily, while the supervisor indicated that enough melon is cut up for a 3-day supply.

Three food handlers reported being sick with a diarrheal illness (Jenny Costella, Joe Kendall, and Nicholas Fisher), including one employee who routinely cuts melons. The employees all reported eating items from the breakfast buffet. The employees became ill on March 25th. One of the ill staff members reported that the only item he had eaten was a bowl of honeydew melon on March 23rd.

Question 10: Do you think it is likely that an infected staff member was the source of the outbreak? Refer to the kitchen staff schedule (Appendix B), the results of the environmental assessment (Appendix C), and the epidemic curve.

The results of the environmental assessment indicate that the kitchen staff practiced good hygiene and properly stored, thawed, and cooked all food. Additionally, staff member symptoms began after the onset of case symptoms, and ill employees were not allowed to be at work while they had symptoms. You and your team decide it is unlikely that a food worker or food handling practices at the hotel were the source of contamination.

Your team decides to conduct a traceback investigation to determine where the melons served during the week of March 21-28 came from.

Question 11: What information do you need to conduct a traceback investigation? What agencies should you partner with to conduct the traceback investigation?

Reports from some kitchen staff indicated that recent melon shipments were excessively dirty or of low quality. Invoices were obtained for a traceback investigation. These invoices indicated: the name/brand of product; the shipping date; lot numbers; the quantity/weight of melons purchased; and the name of the distributors.

FDA conducted a traceback investigation on the lot number(s) and source(s) of the honeydew melon. Two distributors had been supplying the kitchen with honeydew melons. Honeydew melons were traced to two farms in California from which the implicated melons were shipped. The U.S. FDA investigation was inconclusive with respect to a possible source of contamination. There were no indications that farm workers were ill at the time of harvest and handling for shipment. Canal water samples on the farms were negative for *Shigella*.

Summary

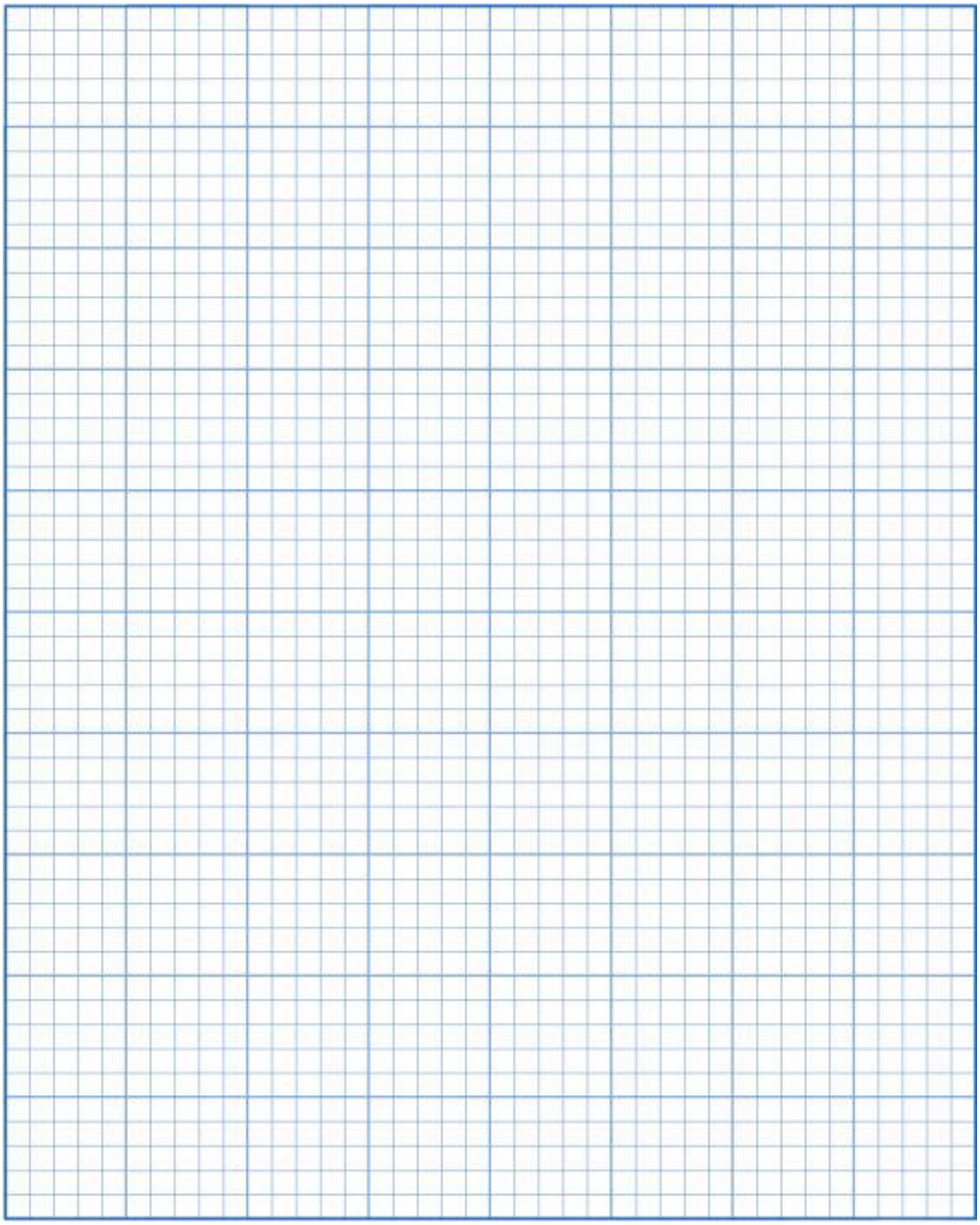
Results of the investigation indicated that an outbreak of *Shigella sonnei* occurred among guests and employees of Hotel A. Epidemiologic and environmental evidence implicated the honeydew melon served at the breakfast buffet. Contamination cannot be pinpointed to a specific day but likely occurred during the period of March 21-23. Transmission over several days is likely to have occurred because honeydew melon was reportedly prepared as a batch for serving over multiple days. Kitchen workers were ill following this period and involved in food preparation. Because *Shigella sonnei* is reportedly transmitted by as few as ten organisms, secondary transmission or contamination of foods could have occurred from infected kitchen staff.

A request for a U.S. Food and Drug Administration traceback on honeydew melon used at the Hotel was made. Two distributors had been supplying the kitchen with honeydew melons. U.S. Food and Drug Administration personnel conducted the traceback investigation. Implicated farms were identified in California. No source of contamination was identified.

Pulsed-field gel electrophoresis (PFGE) was performed on the isolates. Six isolates, one from a kitchen worker and five from guests of the hotel were determined to have indistinguishable patterns following restriction with a single enzyme. No additional matching isolates were reported in response to the PulseNet posting.

From 1973 to 2011, melons have caused 34 outbreaks, resulting in 3602 illnesses, 322 hospitalizations, 46 deaths, and 3 fetal losses (Walsh, 2014). Over half (56%) of these outbreaks were due to cantaloupes, 38% to watermelons, and 6% to honeydew. *Salmonella* was the most common enteric disease reported from melon outbreaks, accounting for 56% of outbreaks, with norovirus accounting for 15% (Walsh, 2014). In another study, out of 85 foodborne melon outbreaks in North America, only 2.4% were caused by *Shigella* (Codex Committee, 2011).

Graph Paper



Appendix A: Line list of cases

Interviewee	Sex	Age	Diarrhea	Number Stools (in 24 hours)	Fatigue	Cramps	Myalgias	Nausea	Headache	Fever	Vomiting	Illness Onset	Symptom Duration (Days)
23	F	11	Y	10	Y	Y	N	Y	Y	N	N	3/23/2016 4pm	4
3	M	36	Y	7		Y	N	N	N		Y	3/24/2016 5pm	5
4	M	59	Y	8	N	Y	Y	N	N	N	Y	3/24/2016 5pm	5
17	F	36	Y	7	Y	Y	N	N	N	N	N	3/24/2016 6pm	6
2	F	81	Y	6	Y	Y	Y	N	Y	Y	N	3/25/2016 11pm	6
19	F	61	Y	5	Y	Y	Y	Y		N	Y	3/25/2016 12pm	7
21	M	17	Y	6	Y	Y		Y		Y	N	3/25/2016 3am	8
22	F	19	Y	5	Y		Y	Y	Y	Y	Y	3/25/2016 4am	4
9	M	80	Y		Y	N	Y	Y	N		N	3/25/2016 5pm	6
14	F	89	Y	9	Y	Y	Y	Y	Y	Y	N	3/25/2016 6am	5
5	M	80	Y	5	Y	Y	Y	Y	Y	Y	N	3/25/2016 6pm	6
6	M	1	Y	7	Y	Y	Y	Y	N	N	N	3/25/2016 8am	4
16	F	24	Y	1	Y	N	Y	N	Y	Y	N	3/26/2016 11am	7
11	M	57	Y	8	N	Y	N	N	Y	Y	N	3/26/2016 1am	5
18	F	24	Y	4		Y	Y	Y	Y	N	N	3/26/2016 2am	7
7	F	72	Y	4	Y	N	Y	N	N	Y	N	3/26/2016 4pm	6
15	M	6	Y	3	Y	Y	Y	Y	Y	Y	N	3/26/2016 7am	5
20	F	54	Y	8	Y	Y	Y	N	Y		Y	3/26/2016 8am	7
10	M	39	Y	4	Y	Y	N	N	N	N	N	3/26/2016 9pm	8
13	M	53	Y		Y	Y	Y	N	Y	Y	Y	3/27/2016 1pm	5
1	F	53	Y	7	Y	N	N	Y	Y		Y	3/27/2016 2am	7
12	F	52	Y	7	N	Y	Y	Y	Y	Y	N	3/27/2016 4pm	5
8	M	27	Y	3	Y	Y	N	Y	Y	N	N	3/28/2016 2am	6

Appendix B: Hyperion Hotel Kitchen Staff Schedule

	Monday 3/20/2016	Tuesday 3/21/2016	Wednesday 3/22/2016	Thursday 3/23/2016	Friday 3/24/2016	Saturday 3/25/2016	Sunday 3/26/2016
Rebecca Carey	6-2 PIC	6-2 PIC	OFF	OFF	6-2 PIC	6-2 PIC	6-2 PIC
Jack Foley	OFF	1-10 PIC	1-10 PIC	1-10 PIC	1-10 PIC	1-10 PIC	
Hilary Radcliff	1-10 PIC	OFF	6-2 PIC	6-2 PIC	OFF	OFF	1-10 PIC
Jenny Costella	6-2 PREP	6-2 PREP	6-2 PREP	OFF	6-2 PREP	OFF	OFF
Ryan Zert	OFF	1-9 PREP	OFF	6-2 PREP	OFF	6-2 PREP	6-2 PREP
Peter Donovan	OFF	OFF	OFF	1-9 PREP	1-9 PREP	1-9 PREP	1-9 PREP
Sharon Daugherty	1-9 PREP	OFF	1-9 PREP	OFF	6-2 PREP	6-2 PREP	OFF
Martin Vasquez	8-5 LINE	OFF	OFF	OFF	8-5 LINE	8-5 LINE	8-5 LINE
Joe Kendall	OFF	8-5 LINE	8-5 LINE	8-5 LINE	8-5 LINE	OFF	OFF
Nicholas Fisher	8-5 LINE	8-5 LINE	8-5 LINE	8-5 LINE	OFF	OFF	OFF
Robert Anselmo	4-10 LINE	4-10 LINE	4-10 LINE	OFF	OFF	8-5 LINE	8-5 LINE
Nadira Barrett	OFF	OFF	OFF	4-10 LINE	4-10 LINE	4-10 LINE	4-10 LINE
Eton Grubbs	OFF	OFF	OFF	4-10 LINE	4-10 LINE	4-10 LINE	4-10 LINE

	Monday 3/27/2016	Tuesday 3/28/2016	Wednesday 3/29/2016	Thursday 3/30/2016	Friday 3/31/2016	Saturday 4/1/2016	Sunday 4/2/2016
Rebecca Carey	6-2 PIC	6-2 PIC	OFF	OFF	6-2 PIC	6-2 PIC	6-2 PIC
Jack Foley	OFF	1-10 PIC	1-10 PIC	1-10 PIC	1-10 PIC	1-10 PIC	
Hilary Radcliff	1-10 PIC	OFF	6-2 PIC	6-2 PIC	OFF	OFF	1-10 PIC
Jenny Costella	OFF	OFF	6-2 PREP	OFF	6-2 PREP	OFF	OFF
Ryan Zert	OFF	1-9 PREP	OFF	6-2 PREP	OFF	6-2 PREP	6-2 PREP
Peter Donovan	OFF	OFF	OFF	1-9 PREP	1-9 PREP	1-9 PREP	1-9 PREP
Sharon Daugherty	1-9 PREP	OFF	1-9 PREP	OFF	6-2 PREP	6-2 PREP	OFF
Martin Vasquez	8-5 LINE	OFF	OFF	OFF	8-5 LINE	8-5 LINE	8-5 LINE
Joe Kendall	OFF	OFF	8-5 LINE	8-5 LINE	8-5 LINE	OFF	OFF
Nicholas Fisher	OFF	OFF	8-5 LINE	8-5 LINE	OFF	OFF	OFF
Robert Anselmo	4-10 LINE	4-10 LINE	4-10 LINE	OFF	OFF	8-5 LINE	8-5 LINE
Nadira Barrett	OFF	OFF	OFF	4-10 LINE	4-10 LINE	4-10 LINE	4-10 LINE
Eton Grubbs	OFF	OFF	OFF	4-10 LINE	4-10 LINE	4-10 LINE	4-10 LINE

List of Abbreviations:

- **PIC:** Person-In-Charge
- **PREP:** Meal preparation
- **LINE:** Meal production

Appendix C: Environmental Assessment Report

Facility: Hyperion Hotel
Facility Type: Commercial FSO
Inspection Type: Outbreak
Inspection Date: 03/30/2016

Comments:

Critical Control Comments – Employee Health-Facility excludes workers with illness symptoms. Facility requires workers to have a doctor's excuse to return to work. PIC is aware of reportable diseases.

Personnel Cleanliness – All food employees wore clean clothing. Observed kitchen employees wearing proper hair restraints.

Handwashing – Facility has hand washing policy. Observed hand sinks properly stocked with hot and cold water, soap, paper towels, hand washing sign, and trash can.

Cross Contamination – Observed proper segregation of raw meat products and ready-to-eat foods.

Cooking – PIC reports all foods are cooked to proper cooking temperatures. Facility offers undercooked hamburgers with appropriate consumer advisory.

Thawing – PIC states that food is thawed under refrigeration.

Cooling – PIC states that no food is cooled.

Reheating – PIC states that no food is reheated.

Cold Holding – Foods held should be stored at 41°F or below. Facility has a corporate HACCP plan that is now in place. Temperatures are logged every two hours.

Hot Holding – Foods held should be stored at 140°F or above. Temperatures are logged every two hours.

Source – All food is from approved corporate supplier.

Date Marking – All food was properly date-marked.

Dishwashing – The three-compartment sink was properly set up. Test strips were available. Mechanical dishwasher is working properly.

Thermometer – Probe thermometer was available.

Highly Susceptible Population – Facility does not serve a highly susceptible population.

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This case study was developed by the Colorado Integrated Food Safety Center of Excellence in collaboration with the original investigators. Some aspects of the outbreak investigation have been altered for the purposes of this case study. Additionally, the methods utilized in this case study reflect the approach used for this particular outbreak. Outbreak response procedures, policies, and methods may vary by country, state, or local jurisdiction.

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