

Title: Foodborne pathogenic occurrence, microbial importance, and Food safety/ security.

Due date: Aug. 02nd

50 Points Total

Part A:

Case study #1

Your neighbor, Mary is a 70-year old woman complains 4-day history of abdominal cramps, headache and 8–10 episodes/day of watery diarrhea. She was not terribly concerned until this morning when she noticed blood in her stool. She reports no fever or vomiting. Martha has no history of other gastrointestinal disorders, only suffering from an occasional bout of self-limiting diarrhea. In your discussions with Mary, you learn that she attended the high school graduation of her youngest grandchild 8 days ago. Mary believes that it was at this celebration that she became ill, chiefly because her son is also feeling poorly, though none of the other guests are feeling ill. The family had a barbeque in which chicken, veggie burgers, baked potatoes and cake were served. Mary also ate a veggie burger and a baked potato. Mary drank apple cider, whereas the rest of the family drank water or sweet tea. She also ate two servings of macaroni salad. She particularly remembers having to go in the house to get the second serving of macaroni salad out of the fridge because her daughter in law returned the macaroni salad to the house immediately after serving the others.

Questions:

1. What is the likely etiologic agent?

It is likely the *Staphylococcal aureus* bacteria on the nose and skin of healthy individuals and could easily transferred to foods. This is well known etiologic agent which when it grows in food, it emits enterotoxins that causes a variety of symptoms upon ingestion such as cramping, headache and diarrhea (Switaj et al., 2015).

2. What food is likely to be associated with their illness?

For this case, *S. aureus* food poisoning was likely associated with the macaroni salad. Since macaroni is food that involves lots of handling, and it was ingested when cold, it was possibly contaminated. In a recent Health line article, Krause (2017) outlined that *S. aureus* is easily transferrable to foods that involve lots of contacts as well as cold salads such as chicken, tuna and macaroni. Other scholarly studies such as Nazzal et al. (2012) have linked cold macaroni salads to *S. aureus* food poisoning. For this case, either Mary herself met contamination resulting from the salad preparation or most probably after ingesting it while it was cold from the fridge.

3. Did you discount any of the foods as the carrier? If so why?

If the rest of the family ate chicken, veggie burgers, baked potatoes and cake and were fine, there are less likely to have caused the illness to Mary. Also, it is justifiable to strike off the apple cider because it would only have caused diarrhea is taken in excessive quantities which was not the case for Mary. Otherwise, during the party, Mary never touched family drank water or sweet tea which are discounted as well. Besides, Mary consumed no other cold foods that would create susceptibility to *S. aureus* food poisoning.

4. In public interest, specify your recommendations to avoid foodborne illness in each case study.

- i) For salad safety, one should engage in thorough or 'triple' washing of ingredients especially the macaroni (CDC, 2018).
- ii) Adequate hand-washing while food handling.
- iii) Adequate refrigeration to keep harmful bacteria at bay, until the last moment of consumption.
- iv) Avoid mixing of utensils or chopping boards in the salad preparation (CDC, 2018).

Case study #2

The doctor enters his examination room to find a Rob, a boisterous 2-year old playing with a truck while his pregnant mother, Shelly watches him from the examination table. Shelly has not been feeling well for the last week, she attributes her pregnancy to her not feeling well. However, she has begun having chills, muscle aches, fever, headaches and sore throat. As this is early summer, you do not suspect influenza. Upon examination, she has a low-grade fever and her cervix has started to dilate even though she is only 28-weeks pregnant. In questioning Shelly, Doctor learned that her husband and co-workers are all healthy; however, Rob complained of mild nausea, diarrhea, and low-grade fever a week ago after he and his mother visited a dairy farm with his playgroup. Shelly and the kids ate picnic lunches of peanut butter sandwiches, chips, cookies, and milk. The milk was fresh from the cow and little Rob had been asked to help milk the cow! Shelly and Rob shared a snack of fresh, soft cheese that they purchased from the dairy and crackers. Shelly had been careful to keep the cheese on ice until they ate their snack. That night Shelly was beat, so she and the family ate at the local pizzeria for dinner. Rob awoke during the night with the symptoms, which lasted approximately 2 days, though Shelly and her husband felt fine. None of the other children were sick the next day.

Questions:

1. What is the likely etiologic agent?

Most probably Rob is suffering from bacterial gastroenteritis that may be caused by salmonella bacteria which is often common in children (Better Health, 2020). Its symptoms include fevers, headaches, sore throat, nausea and vomiting which are exhibited by Rob in the case study (Sattar and Singh, 2021).

2. What food is likely to be associated with their illness?

Milk as the dairy product is the likely cause of contamination in terms of bacterial gastroenteritis (Sattar and Singh, 2020). From the case above, it is evident that Rob consumed the milk while it was fresh, and moreover, he participated to milking the cow. It is most probable that his help in milking was a source for contamination.

3. Did you discount any of the foods as the carrier? If so why?

I struck out cheese for Shelly kept it very cold, as required, until it was ingested. Other foods that I would rule out are non-dairy such as chips and crackers that are less likely to aggravate stomach flu.

4. In public interest, specify your recommendations to avoid foodborne illness in each case study.

- i) A consumer can opt for pasteurized milk which is often heated to kill of any possible salmonella bacteria. This means strict avoidance in consuming raw milk and dairy products (Galanis, 2007).
- ii) Proper sanitization and hygiene during milking, including thoroughly washing udders with water having disinfectants (Fletcher, 2018).
- iii) Avoiding sharing of containers and tools during the milking of the cows.
- iv) If anyone joins in milking, they should be thoroughly cleaned, especially in hand washing (Fletcher, 2018).
- v) The use of clean containers in serving milk.

Case study #3

On Friday night Tom and his son Jack embarked on a man's bonding expedition. They hiked out into the woods and established a campsite, where they cooked beans and sausage over their campfire. Saturday, was a beautiful day for hiking and fishing. Tom and Jack spent all day in the boat, even eating pre-packed protein bars for lunch. That evening the men came back to camp and cooked the fish they caught for their dinner. Tom and Jack awoke on Sunday morning to enjoy a delicious meal of re-constituted pasteurized eggs and summer sausage cooked over the fire. That evening Tom and Jack hiked back to their truck and prepared to go home. The men were hungry and stopped for dinner at a steakhouse, where Tom ate a well-done steak and a side salad, whereas

Jack devoured a giant well-done hamburger and fries. Afterward, they stopped at the local Creamery for an after-dinner treat. Tom had the White Chocolate Mint in a cone, whereas Jack chose the Cake Batter Ice Cream in a dish. The next morning Jack awoke for school and immediately began complaining of stomach pain and headache. It was very shortly after when he began vomiting. He had a slight fever of 101^F. Within several hours of his vomiting, he also developed a moderate case of diarrhea. Jack's symptoms continued for 4 days, whereas Tom and the boy's mother continued to feel fine. Jack was diagnosed with acute infectious gastroenteritis by routine stool culture.

Questions:

5. What is the likely etiologic agent?

It is likely to be salmonella which is a common cause of acute gastroenteritis in infants and young children (Elliot, 2007). Acute gastroenteritis unfolds as an inflammation of the intestines and stomach resulting in vomiting, diarrhea and other digestive upset symptoms (Graves, 2013). These are the observable symptoms exhibited by Jack.

6. What food is likely to be associated with their illness?

The meal that was possibly contaminated with the salmonella bacteria was the Cake Batter Ice Cream that Jack ate at the local Creamery. Some forms of ice-cream are known to have this bacteria and could cause a wide range of symptoms such as fever, abdominal pain, vomiting and diarrhea (Bintsis, 2017). There is a renowned case where in mid-2005, FDA sent a warning (and product recall) over a salmonella outbreak across several states attributed to ingestion of cake batter ice cream from Cold Stone Creamery outlets (Hitti, 2005). The Cake Batter Ice Cream is therefore the most probable food that subjected Jack to acute gastroenteritis.

7. Did you discount any of the foods as the carrier? If so why?

I was able to discount meals that were shared between Jack and his father, Tom, mainly because the latter was seemed to be in perfect health. For instance, if the re-constituted pasteurized eggs and summer sausage were contaminated, both individuals would have shown certain symptoms, even to a small scale. Also, there is very minimal risk that the hamburger and fries could have bacterial infection as the risk is often in beef, chicken, fruits, eggs and pork.

8. In public interest, specify your recommendations to avoid foodborne illness in each case study.

- i) Proper sanitation should be adhered in ice cream preparation including cleaning ramps and ramp ways to eliminate any bacterial growth (Foodsafe Drains, 2019)
- ii) Consumers should avoid finger licking and still to using a clean serving utensil.
- iii) Always consume frozen ice-cream and be ready to toss it away if it melts.
- iv) Ice cream made using pasteurized eggs and milk is not recommended as these two facilitate cross-contamination (Foodsafe Drains, 2019).
- v) Clear coding of tools since the mixing of tools encourages cross-contamination.

Case study #4

We begin this tale of gastrointestinal woe with Nick, and his wife Sally, who is just returning from a second-honey- moon at Niagara Falls. Nick's father Tim has been taking care of the couple's two active boys, Jacob and Jacky, for the last week. On Friday night Nick and Sally arrive home and stop by the delicatessen to pick up some shredded pork barbeque and coleslaw from a convenience-market. The pork was reheated in their home microwave, and Nick, Sally and Tim sat down to dinner within 30 minutes after it was purchased. The boys, on a recent vegetarian kick, refused the barbeque but instead ate coleslaw and potato chips for dinner. Approximately 3–4 hours after eating the meal, the three adults had nausea, vomiting, and stomach cramps. Jacob and Jacky felt fine. The three adults were taken to a hospital for evaluation, where they were treated and released. Vomiting ceased after treatment with a phenothiazine, and nausea and cramps resolved the following day.

Questions

9. What is the likely etiologic agent?

The food poisoning in the food is likely caused by the trichinella parasite. Trichinosis is revealed in a wide range of symptoms including nausea, vomiting and abdominal pains which are exhibited by the three adults (Rawla and Sharma, 2020).

10. What food is likely to be associated with their illness?

The likely food was the shredded pork barbeque since the symptoms were revealed only in adults as opposed to children who opted for a vegetarian diet. Besides, this parasitic toxin is found in raw or undercooked mammalian meat, especially in pork (Roesel et al., 2016; Franssen et al., 2017).

11. Did you discount any of the foods as the carrier? If so why?

I was able to discount coleslaw and potato chips from the list of foods that could cause harm. First, the children who ate these two food types did not experience any symptoms that would indicate any sign of food poisoning. Additionally, the parasite trichinella is often found in meat such as in pork or wild game meat that has not been cooked or frozen properly (Franssen et al., 2017). Therefore, the most likely carrier would be the shredded pork that was eaten by the adults in the household.

12. In public interest, specify your recommendations to avoid foodborne illness in each case study.

- i) It is important to thoroughly wash one's hands before and throughout the cooking process (Mayo Clinic, 2020).
- ii) In preparation of the barbeque, the grill should be thoroughly washed as well.
- iii) Use of two set of tools (for raw food and cooked food) is ideal to avoid cross contamination.
- iv) It is not recommended to defrost meat in a microwave, as the center may still be frozen while the sides warm up. It is, therefore, important to defrost it overnight (Mayo Clinic, 2020).
- v) For cooked food, it is vital to refrigerate them adequately such as to 165°F or until they steam hot. Poor reheating could be a source of food poisoning (Mayo Clinic, 2020).

Part B:

Q1. Famous Frank's Freshly Frozen Fabulous Pot Pies is losing market share and rapidly becoming less famous as the demand for "fresh, never frozen" food increases, Frank knows that he has to change and figures that going fresh is no big deal. (Just skip the freezing step!) He hires you, the company's first microbiologist, to advise him on what, if any, special challenges might be presented by these fresh products. What advice do you give him?

In a position of a consultant microbiologist, I would make Frank aware of the role of refrigeration and the impact on food security. It would be a major risk for Frank to skip the freezing step, not only due to negative publicity to his brand but also a health risk. Proper storage of food at low temperature aims to keep the food safe away from harmful microorganism that cause different illnesses (Bintsis, 2017). The harmful microorganisms cannot survive at these low temperature and thus, freezing sustains ideal food quality and ensure that ultimately the consumers will consume safe food therefore avoiding any illnesses and conditions.

Q2. You are interested in the preservation of salad ingredients, including salad dressing, so that you can ship them across the country. To increase the shelf life and retain fresh-like characteristics, you want to use novel nonthermal technologies. How will you choose to process your product? Is there a benefit to using specific technologies for specific foods?

The reliance of novel nonthermal techniques such as ultrasounds, pulsed light treatment and pulsed electric fields is increasingly common in support food quality through inactivation of microorganisms and avoiding thermal decay of the components (Chacha et al., 2021). For the case of preservation of salad ingredients, I will select one ideal method such as use of e-beam processing. It is a reliable technique that I can steadily apply to certain quantities of salad ingredients to preserve their quality and safety. The beam will scan the packaged food back and forth to ionize the food keeping it in a fresh-like manner. The main benefits is that it is both a chemical-free and radiation-free approach that would not have any harmful impacts on the food.

Part C:

Q1. There has been criticism that the United States is limited by not having one solid public health and regulatory agency controlling food safety. Read about these criticisms in current literature and explain your opinion in agreement for today's system or not.

There are a handful article that seem to attack the decentralization of control to public health and food safety oversight. Apparently there are close to a dozen agencies at the federal level that enforce over 35 statutes regarding food safety. Four main ones include; DHH's Food and Drug Administration (FDA), USDA's Food Safety and Inspection Service (FSIS), the Environmental Protection Agency (EPA) and National Marine Fisheries Service (NMFS). While critics seem to make a fair observation, they tend to downplay the complexity and size of the US food and health markets. The main counterargument is that centralization is not always the winning card and it is perfectly okay to have every agency accomplish specific roles in regulation. For instance, NMFS mandate is on fish and sea food which is an ideal sphere in the overall food market. Even with differentiated roles, these agencies need to work harmoniously, not competitively, and ultimately control will be more effective. Therefore, with sufficient coordination, and goal-based approach to control, having different agencies for food control is justified.

Q2. What is the current state of the FSMA? How is it affecting food production companies, including those that produce fruits and vegetables?

The Food Safety Modernization Act is a strong and viable legislation that guides how the FDA undertakes its enforcement activities. By relying on this legislation, the FDA establishes rules by which companies have to adhere to ensure food safety. For instance, the Hazard Analysis and Risk-Based Preventive Controls for Animal Food rule require food processors to fully comply with the good manufacturing practices (FDA, 2020). As for the companies in fruits and vegetables production, FDA rule such as the Produce Safety rule is essential to ensure minimum standards are met in terms of growing, harvesting, packing, and holding food for human use. For instance, organically grown vegetables should strictly meet the conditions for them to end up in the market as safe. Therefore FSMA works towards harmony, equality and full compliance to the safety and health of all food consumers, within and beyond American borders.

Q3. Using the four objectives of FoodNet as your guide, describe real-life examples that demonstrate how these objectives are being met and how the four play-off of each other. (Hint: think about current outbreaks in foodborne pathogens).

Food surveillance is a critical component in ensuring healthy populations at every location of the country. Drawing from its website, FoodNet currently surveys a couple of parasitic pathogens and seven bacterial pathogens including STEC infection, *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria*, and *Salmonella*. In a real life example, the CDC on mid-April 2021 concluded an investigation involving a drug-resistant *Campylobacter* infection. Surveillance efforts linked this multistate infection to pet store puppies from January 9 2019 to March 1 2021. The report outlines that 56 individuals were infected from 17 states leading to 9 hospitalizations and luckily, no deaths (CDC, 2021). As a tax-funded program, FoodNet is essential utilizing both epidemiologic and laboratory evidence to track down cases of the outbreak. The goal based approach used by the program is ideal to gather data in terms of prevalence, specificity and what is required to quell the prevalence. The four objectives are simple but powerful to ensure speedy surveillance and intervention. Besides, the goals are linked to facilitate a holistic approach. For instance, where disease trends indicate illness, what it is attributable to and sharing of information to create interventions. Therefore, the goals offer the ultimate guide to detect illnesses and keep the people.

Q4. Describe the roles of programs like the *Codex Alimentarius* and (Global Hunger Index) GHI in food security.

The *Codex Alimentarius* may be dominantly viewed as the trade standards for food but they offer protection to the consumers' health as well ensuring safe food practices in the food consumption (Tritscher, 2015). Companies in the food industries for instance have to adhere to maximum levels of food additives and contaminants so that the qualities of food sold are safe for consumption. These and other codes ensure safe food practices are adopted and thus are of great relevance in the global food chains. On the other hand, GHI aims to track and measure hunger regionally and at the country levels. These levels help inform the International Food Policy Research Institute (IFPRI) on the food scarce regions and direct action such as resources to help combat hunger. In essence, therefore, GHI scores help fight food insecurity and support health and wellbeing of populations.

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