NO PREP

Foodborne Illness

The Pathogens That Make People Sick

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

Foodborne Illness: The Pathogens That Make People Sick

Forty-Eight Million People a Year

In estimates published in 2011, the Centers for Disease Control and Prevention calculated that about 48 million people in the United States get sick from contaminated food each year. That is roughly one in six Americans. Of those, about 128,000 end up in a hospital and about 3,000 die. Those numbers are worth sitting with for a second, because foodborne illness has a public relations problem. People call it food poisoning and treat it like a bad night, an unfortunate burrito, a story you tell later. For most healthy teenagers, that is honestly what it is. For an infant, a pregnant woman, someone over sixty-five, or anyone whose immune system is weakened by chemotherapy or a chronic illness, the same meal can mean an

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Bacteria: The Names You Should Know

Bacteria cause the majority of serious foodborne illness, and a handful of species do most of the damage. Salmonella is the classic. It lives in the intestines of poultry and other animals and turns up in raw chicken, eggs, and occasionally produce contaminated by irrigation water. It causes fever, cramps, and diarrhea, usually starting somewhere between six hours and six days after exposure. Escherichia coli O157:H7, usually written E. coli, is far rarer but far more dangerous. It comes primarily from ground beef and from leafy greens grown near cattle operations, and it can produce a toxin that shuts down the kidneys, especially in young children. Listeria monocytogenes is unusual because it grows at refrigerator temperatures, which defeats the main defense most people rely on. It shows up in deli meats, hot dogs, soft cheeses made from unpasteurized milk, and smoked seafood, and it is the reason pregnant patients get handed a list of foods to avoid. Clostridium botulinum produces the toxin behind botulism, thrives without oxygen in improperly home-canned foods, and attacks the nervous system. Staphylococcus aureus lives on human skin and in noses, gets into food through bare hands, and produces a toxin that cooking will not destroy. That last detail matters more than it sounds: with staph, reheating the food does not fix it. Clostridium perfringens deserves a mention too, because it specializes in exactly the food a school or church kitchen produces. It thrives in large batches of meat, gravy, and stew that cool too slowly, which has earned it the nickname the cafeteria germ. Every one of these organisms is defeated by the same short list of controls covered in this unit.

Viruses, Parasites, and the Rest of the Lineup

Bacteria get the headlines, but the single most common cause of foodborne illness in the United States is a virus. Norovirus has accounted for something like half of all reported outbreaks. You may know it as the cruise ship bug or the stomach flu, though it is not related to influenza at all. Norovirus spreads through the fecal-oral route, which is a clinical way of saying that microscopic particles travel from a bathroom to a food surface on unwashed hands. It takes an astonishingly small dose to infect someone, it survives on surfaces for days, and ordinary hand sanitizer does not reliably kill it. Soap, friction, and running water do. This is the single strongest argument for the handwashing rules in the next reading. Hepatitis A is another virus transmitted the same way, though it attacks the liver and can be prevented with a

vaccine. Parasites are less common in the United States but still real. Trichinella is associated with undercooked pork and wild game, Giardia with contaminated water, and Anisakis with raw fish that was not frozen properly first. Finally, not everything that makes people sick is alive at all. Chemical contamination from cleaning products stored above food, and physical contamination from glass, metal shavings, or a piece of jewelry, both count as foodborne hazards and both show up in real incident reports. Allergens belong on the list as well. For a person with a peanut or shellfish allergy, a trace amount transferred by a shared utensil is a medical emergency that has nothing to do with bacteria, which is why allergen control is treated as a food safety responsibility rather than a customer preference.

The Big Six and the Fecal-Oral Route

Food safety regulators single out a short list of pathogens as unusually contagious and unusually dangerous. They are commonly called the Big Six: Norovirus, Hepatitis A, Salmonella Typhi, non-typhoidal Salmonella, Shigella, and Shiga toxin-producing E. coli. What these six have in common is that they transmit easily from person to person, which means an infected food worker is a genuine outbreak risk on their own. That is why health codes require a food worker diagnosed with any of the Big Six to be excluded from the kitchen entirely, not simply reassigned to a job away from food. The transmission path for most of them is the fecal-oral route. It is an unpleasant phrase, and students usually want to skip past it, but understanding it is what makes the rules make sense. Microscopic material from an infected person's intestines reaches their hands, then a doorknob, a phone, a cutting board, a sandwich, and then someone else's mouth. Nobody in that chain does anything visibly disgusting. The amounts involved are invisible. This is why a food worker with vomiting or diarrhea must stay home rather than tough it out, and why handwashing after using the restroom is a legal requirement rather than a suggestion. It also explains a rule that seems excessive until you follow the chain: after a vomiting incident, a kitchen must be closed off and cleaned with a chlorine solution far stronger than routine sanitizer, because Norovirus particles aerosolize and settle on surfaces several feet away from where the incident happened.

Who Actually Gets Hurt

The same dose of the same pathogen produces wildly different outcomes depending on who eats it. Public health workers use the acronym YOPI for the four highest-

risk groups: the Young, the Old, the Pregnant, and the Immunocompromised. Children under five have immune systems that are still learning and body weights small enough that dehydration becomes dangerous fast. Adults over sixty-five have immune responses that have slowed with age and often have other conditions that complicate recovery. Pregnancy suppresses parts of the immune system, and some pathogens, Listeria most notoriously, can cross the placenta and cause miscarriage or stillbirth even when the mother's own symptoms are mild. People who are immunocompromised, whether from cancer treatment, an organ transplant, HIV, diabetes, or long-term steroid use, may not be able to mount a response at all. This is why food safety rules in a school lab are written for the strictest case rather than the average one. The healthy seventeen-year-old cooking the food is usually not the person most at risk from it. In a family, a church supper, a catering job, or a childcare center, the food you prepare will reach somebody in a YOPI group. Cooking safely for the most vulnerable person at the table is the entire professional standard, and it is not a high bar to clear once the habits are in place. There is one more reason the standard is written this way. You usually cannot tell who is in a YOPI group by looking at them. Pregnancy is often invisible in the first months, and nobody announces a transplant or a chemotherapy schedule to the person making their sandwich.

Key Information: Common Foodborne Pathogens

Detail	Information
Annual US Cases	About 48 million illnesses, 128,000 hospitalizations, 3,000 deaths (CDC 2011 estimates)
Most Common Cause	Norovirus, estimated at roughly half of all reported outbreaks
Salmonella	Poultry, eggs, and produce; fever, cramps, and diarrhea
E. coli O157:H7	Ground beef and leafy greens; can cause kidney failure
Listeria	Deli meats and soft cheeses; grows at fridge temperatures
Staph aureus	Spread by bare hands; its toxin survives cooking

Detail	Information
The Big Six	Pathogens so contagious that infected workers are excluded
YOPI Groups	Young, Old, Pregnant, and Immunocompromised are highest risk

Case Study: The Catering Job and the Sick Saturday

Alexis is seventeen and works weekends for a small catering company. On Friday night she woke up twice with vomiting and stomach cramps. By Saturday morning she felt drained but no longer sick, and the company was short-staffed for a wedding reception serving two hundred people. She texted her manager: "I was sick last night but I feel okay now, I can come in." Her manager told her to stay home for another forty-eight hours after her last symptom, and offered to pay her for the shift anyway. Alexis argued that she would wear gloves and only plate cold food. Her manager explained that Norovirus sheds in enormous numbers for days after symptoms stop, that gloves do not stop transmission if the hands underneath are contaminated, and that the guest list included two pregnant women and a grandmother recovering from chemotherapy. Alexis stayed home. Nobody at the reception got sick.

1. Alexis felt fine and planned to wear gloves. Using the reading, explain why her manager still excluded her from the shift.

2. The manager mentioned specific guests at the reception. Connect that detail to what the reading says about who suffers the worst outcomes.

Multiple Choice

1. Which pathogen causes the largest share of foodborne illness outbreaks in the US?

a) Listeria monocytogenes

b) Salmonella

c) Norovirus

d) Clostridium botulinum

2. What makes Listeria unusual compared with most other foodborne bacteria?

a) It keeps growing at refrigerator temperatures

b) It only grows in canned goods

c) It cannot be passed to an unborn child during pregnancy

d) It is destroyed by any amount of heat

3. Why must a worker diagnosed with a Big Six pathogen be excluded from the kitchen?

a) Their symptoms make lifting heavy pans unsafe

b) These pathogens only live on cooking equipment

c) Health codes require a doctor to inspect the kitchen

d) These pathogens spread easily from person to person

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ pathogen	A) The acronym for the four population groups at highest risk of severe illness
2. ___ fecal-oral route	B) A microorganism capable of causing disease in a person who consumes it
3. ___ YOPI	C) A poisonous byproduct some bacteria leave behind that cooking may not destroy
4. ___ toxin	D) The short list of pathogens contagious enough to require excluding a worker
5. ___ Big Six	E) The path by which invisible waste material travels from hands to food to mouth

Fill-in-the-Blank

1. About _____ million Americans get a foodborne illness each year.

2. _____ is the only listed pathogen that grows in the refrigerator.

3. The Y in YOPI stands for the _____, meaning children under five.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain why you cannot rely on sight, smell, or taste to tell whether food is contaminated.

2. Why does the reading say staph food poisoning is not fixed by reheating the food?

3. Argue why school lab rules should be written for the most vulnerable eater, not the average one.