students must be able to recognize what they can control within their operation in order to reduce the risk of a foodborne illness outbreak. The overall goal is to reinforce the concept that as managers their actions influence the food safety culture of the organization.

Teaching and Learning Objectives

Identifying the employee, the food, the behavior, and the pathogen through a logic problem requires the students to critically think about the actions of all of their employees. This approach takes the learning objective to a higher level of Bloom's Taxonomy. In this case, the student is analyzing the concepts by identifying components, recognizing patterns, and predicting consequences. After completing this case study, students should be able to:

- Identify specific symptoms associated with various foodborne pathogens
- Interpret employee behaviors that contribute to foodborne illnesses and make recommendations for changing these behaviors in order to become permanent fixtures of standard operating procedures
- Distinguish which potentially hazardous foods are associated with specific pathogens
- Predict and draw conclusions as to which type of food, which employee, what behavior and what type of microorganism contributed to this outbreak

Target Audience

The target audience for this case study is for undergraduate students enrolled in an introductory Food Safety and Sanitation course. Ideally, this exercise would be given towards the end of the semester. It could even be used as a review for the final exam.

Teaching Approach

Students will be asked to form small groups of no more than 3 people per group. Each group will be given instructions to identify the employee, the food that caused the outbreak, the behavior of the employee, and the specific pathogen. It works well if you have students write down their answer and turn it in so that you can see how many understood the exercise. The group work takes approximately 20 to 25 minutes to complete and then allow time for a class discussion afterwards.

The discussion questions are designed to emphasize each of the objectives and explain the logic needed in order to arrive at the correct conclusion.

Discussion Points:

What employee behaviors can we control when managing employees? Name specific ways that control measures can be put into the operation.

Possible Answers: Monitoring Improper Cooking/Improper Cooling/Time & Temp- recording temperatures, ensuring the time that products are received, stored, prepared and served outside of the danger zone (41°F to 135°F). Poor Hygiene- implement a hand washing index, create policies and an environment that states when employees should be excluded from work and follow it. Unapproved Sources- ensure that products are purchased from reputable vendors who meet the state and federal requirements.

Which of the employee behaviors in this case study were followed correctly? Which of the employee behaviors were not followed correctly? What would you do as a manager to prevent this from happening again?

Possible Answers: Example of good behaviors: hygiene: Mr. Green washed his hands, Ms. Peacock's daughter was sick and she missed work, Time/Temp: Although *E. coli* 0157:H7 may exist in ground beef, the burgers were cooked to 155°F, Frozen chicken tenders cooked to 165°F and held at 138°F; Beef Stew was prepared two days ago, cooled to 70°F within 2 hours, 41°F four hours later then reheated to 165°F, oysters were served on ice. Approved sources: oysters shell stock tags kept for 90 days, hamburgers. Incorrectly followed: Poor personally hygiene: Ms. White has a small cut on her left hand. While she doesn't need to be excluded from working, she needs to bandage the wound and wear protective disposable gloves.

Using your current knowledge of the pathogens presented, which microorganisms could you eliminate based on the symptoms and associated food?

Key points: The symptoms were nausea and vomiting, therefore, *Clostridium perfringens* which causes explosive diarrhea can be excluded. *E. coli* 0157:H7 may exist in ground beef and beef stew; however the burgers were cooked to 155°F and the beef stew was cooled properly and reheated to 165°F which would eliminate pathogens in both items. While Norovirus is often associated with oysters, we know that the oysters were served on ice and harvested from safe waters according to the shell stock tags. Also, Ms. Peacock stayed home when her daughter was sick. We know that the chicken was cooked and hot held properly which would have killed any *Salmonella* that may have been present.

What type of food, which employee, what behavior, and which type of microorganism contributed to the outbreak?

Answer: Ms. White, Ham Sandwich, Poor Hygiene, Staph

As a manager, what steps can you take to instill a food safety culture?

Possible answers: Managers have the greatest influence on the culture by implementing and demonstrating good practices and policies. It is also important to verify that the proper procedures are being followed. Managers and employees must enforce and adhere to the policies so that everyone clearly understand that "it is the way we do business here."

What should Victor communicate to those members who became ill? Should he address this with the entire membership?

Possible answers: While it may be uncomfortable, honesty is always the best policy. It is important to be transparent to the membership. He should personally call each member that became ill and apologize. Victor should discuss changes to the practices to ensure that this never happens again. As far as the entire membership, there is not a correct answer or right way to approach this. This should prompt an interesting discussion for the class.

Feedback from Students

This case study was implemented in a freshman Safety and Sanitation undergraduate class of over 120 students. Two-thirds of the students were able to correctly identify the employee, food, behavior, and microorganism. Afterwards, the students were asked to provide feedback on the exercise itself. They overwhelming responded that they had fun completing the case study. On a scale from 1 to 10 with 1 being too easy and 10 being too difficult, the students rated the exercise a 6. They felt challenged but were able to complete the exercise. Given the success of this model, the instructors are now revising the content in order to implement this within other courses.

Additional Reading

Bad Bug Book. Available at: http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf.

http://www.foodsafety.gov/

Hand washing index: http://handwashingforlife.com/

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