

Epidemiology

New for 2017 – 2018

A new sample case study has been provided.

Purpose To encourage HOSA members to study the effects of health and disease in populations, to improve their scientific literacy, and to provide insights into public health careers.

Description This event shall be a written examination of concepts related to the study of epidemiology. Individual competitors shall be expected to recognize, identify, define, interpret and apply these concepts in a 50-item multiple-choice test and in written responses to a case study.

Dress Code Competitors must be in official HOSA uniform or in proper business attire. Bonus points will be awarded for [proper dress](#).

- Rules and Procedures**
1. Competitors in this event must be active members of HOSA and in good standing in the category division in which they are registered to compete (Secondary or Postsecondary/Collegiate).
 2. Competitors must be familiar with and adhere to the [“General Rules and Regulations of the National HOSA Competitive Events Program \(GRR\).”](#)
 3. The test will consist of fifty (50) multiple-choice items, AND a case study consisting of between five (5) and twenty (20) short answer questions worth 50% of the final total score.
 4. The official references for the development of all test items and the case study will be entirely web-based.

- **CDC Websites**
<http://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson1/index.html>
<http://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson6/section2.html>
- **Young Epidemiology Scholars**
<http://yes-competition.org/yes/epidemiology-resources.html>
<http://yes-competition.org/yes/epidemiology-resources/glossary.html>
<http://yes-competition.org/yes/teaching-units/intellectual-framework.html>
- **Basic Epidemiology – World Health Organization**
http://apps.who.int/iris/bitstream/10665/43541/1/9241547073_eng.pdf
- **Emerging and Re-emerging Infectious Diseases**
https://science.education.nih.gov/supplements/nih_diseases.pdf
- **Public Health Careers**
<http://www.publichealth.org/careers/>
- **CDC: Disaster Epidemiology and Assessment**
<http://www.cdc.gov/nceh/hsb/disaster/epidemiology.htm>
- **Office of Assistant Secretary for Preparedness & Response**
<http://www.phe.gov/preparedness/Pages/default.aspx>

5. The test plan for the multiple choice items is listed below and separated by website:

CDC website

- An Introduction to Epidemiology 10%
- Steps of an Outbreak Investigation 10%

Young Epidemiology Scholars website

- Intellectual Framework 15%
- Epidemiology glossary 10%

Basic Epidemiology – World Health Organization

- *What is Epidemiology?* 15%
- Measuring Health and Disease
- Types of Studies

Emerging and Re-emerging Infectious Diseases (NIH website)

- Understanding Emerging and Re-emerging Infectious Diseases 15%

Public Health Careers

- Careers in public health 5%

Disaster Epidemiology and Assessment (CDC website)

- CDC Activities 10%
 - Mission, goals and objectives
 - Application and service in disaster settings: surveillance and rapid needs assessment
 - Applied research to prevent injuries, illnesses and deaths
 - Consultation and training
 - Field investigations

Office of the Assistant Secretary for Preparedness & Response

10%

Under the preparation tab

- Responders, Clinicians & Practitioners
- International Preparedness & Response
- Public Health Emergency Response

6. In addition to the multiple-choice items, competitors will apply their knowledge of epidemiology and investigative skills to an epidemiological scenario in the form of a case study. The written case study will be a part of the test packet, and will include background information about a selected public health situation and a series of short answer questions about the case study. (A sample case study is included with these guidelines. The actual case study used in HOSA competition will be a secret problem.)

7. All competitors shall report to the site of the event at the time designated for the event orientation. The test will immediately follow the orientation. **No proxies will be allowed for the orientation.** Calculators may NOT be used.

8. **Test Instructions:** The competitors will be given instructions and will be notified to start the test. There will be a maximum of two (2) hours to complete the test and case study. A notice will be given when fifteen (15) minutes are remaining. Competitors should leave the testing site promptly after completion of the test.

NOTE: States/regions may use a different process for testing, to include but not limited to pre-conference testing, online testing, and testing at a computer. Check with your Area/Region/State for the process you will be using.

9. The tie-breaker will be the case study score.

Competitor Must Provide:

- Event guidelines (orientation)
- #2 lead pencils with eraser
- Watch with second hand (optional)

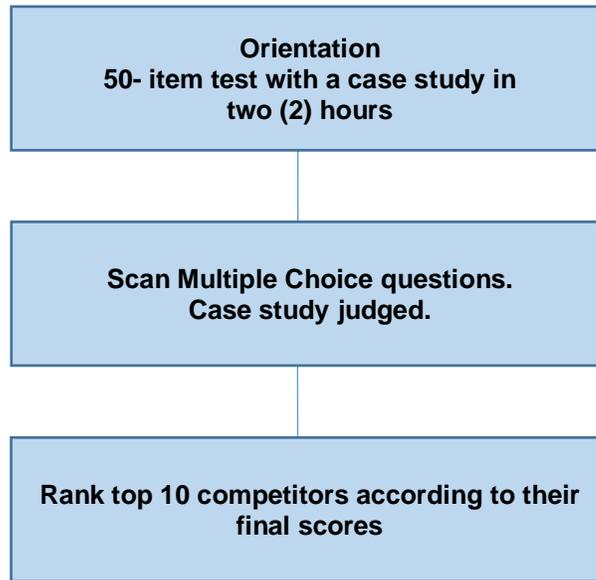
Required Personnel:

- One Event Manager
- One QA to provide quality assurance for the event by ensuring that the guidelines are followed and all event documents are complete.
- One Section Leader
- Two to three Proctors
- Two Courtesy Corps Members
- One - Two judges per section to judge the case study of top scorers

Facilities, Equipment and Materials:

- One room to accommodate the total number of competitors
- Tables/chairs or schoolroom desks/chairs for total number of competitors
- Table/chairs for event personnel to provide for registration, and distribution of materials
- Key for judging the case study portion
- Clock or timer
- Test packets pre-numbered and Scantron / answer forms
- Evaluation Forms – competitor, judge, and personnel
- #2 lead pencils with eraser to complete evaluations

Event Flow Chart



Sample Multiple Choice Test Questions

1. The portion of the incidence of a disease in the exposed that is due to the exposure is:
 - A. attributable risk.
 - B. cohort study.
 - C. risk benefit.
 - D. benefit group.
2. If a study is designed to determine the number of pregnancies during the junior year of high school and *only* includes minority populations, the study is said to be:
 - A. biased.
 - B. confounded.
 - C. limited.
 - D. nonessential.
3. The re-emergence of some infectious diseases, such as the diphtheria outbreak in Russia in the 1990s, is caused by:
 - A. improper sanitation.
 - B. lapses in vaccination programs.
 - C. malnutrition which compromises the immune system.
 - D. radiation from nuclear accidents



[Morbidity and Mortality Weekly Report \(MMWR\)](#)

Outbreak of Salmonella Newport Infections Linked to Cucumbers – United States, 2014

February 20, 2015 / 64(06);144-147

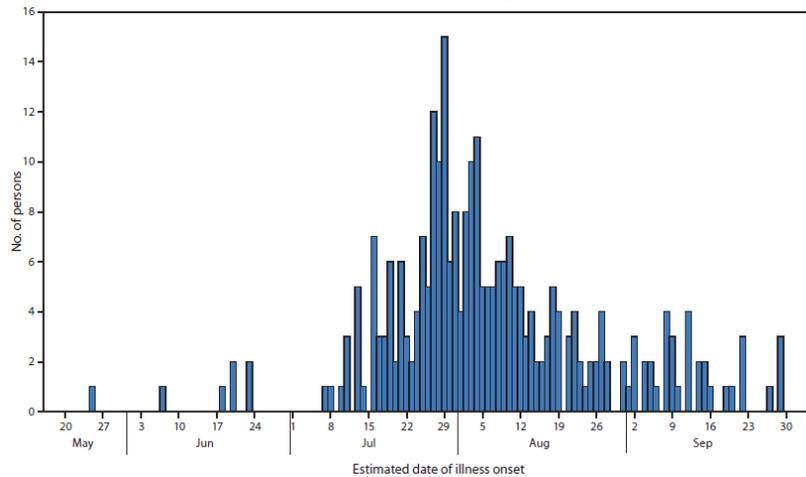
In August 2014, PulseNet, the national molecular subtyping network for foodborne disease surveillance, detected a multistate cluster of *Salmonella enterica* serotype Newport infections with an indistinguishable pulse-field gel electrophoresis (PFGE) pattern (*Xba*I PFGE pattern JJPX01.0061).^{*} Outbreaks of illnesses associated with this PFGE pattern have previously been linked to consumption of tomatoes harvested from Virginia's Eastern Shore in the Delmarva region and have not been linked to cucumbers or other produce items (1). To identify the contaminated food and find the source of the contamination, CDC, state and local health and agriculture departments and laboratories, and the Food and Drug Administration (FDA) conducted epidemiologic, traceback, and laboratory investigations. A total of 275 patients in 29 states and the District of Columbia were identified, with illness onsets occurring during May 20–September 30, 2014. Whole genome sequencing (WGS), a highly discriminating subtyping method, was used to further characterize PFGE pattern JJPX01.0061 isolates. Epidemiologic, microbiologic, and product traceback evidence suggests that cucumbers were a source of *Salmonella* Newport infections in this outbreak. The epidemiologic link to a novel outbreak vehicle suggests an environmental reservoir for *Salmonella* in the Delmarva region that should be identified and mitigated to prevent future outbreaks.

Epidemiologic Investigation

A case was defined as infection with *Salmonella* Newport with PFGE pattern JJPX01.0061 (the outbreak strain) in a person with illness onset occurring during May 20–September 30, 2014. Initial interviews of ill persons conducted by state and local health officials found that travel to the Delmarva region during the incubation period was commonly reported. A structured, focused supplemental questionnaire was developed to collect detailed information on travel and exposure to restaurants, seafood, fruit, and produce, including tomatoes, in the 7 days before illness onset. Exposure frequencies were compared with the 2006–2007 FoodNet Population Survey, in which healthy persons reported foods consumed in the week before interview. Information also was collected on illness subclusters, defined as two or more unrelated ill persons who reported eating at the same restaurant, attending the same event, or shopping at the same grocery store in the week before becoming ill.

A total of 275 cases were reported from 29 states and the District of Columbia. An additional 18 suspected cases not meeting the case definition were excluded from the analysis because they were found to be temporal outliers and unlikely to be related. Illness onset dates ranged from May 25 to September 29, 2014.

FIGURE - Number of persons (N = 275) infected with the outbreak strain of *Salmonella* Newport, by estimated date of illness onset — United States, May 20–September 30, 2014



Median age of patients was 42 years (range = <1–90 years); 66% (174 of 265) were female. Thirty-four percent (48 of 141) were hospitalized; one death was reported in an elderly man with bacteremia. A total of 101 patients were interviewed using the supplemental questionnaire about exposures in the week before illness onset. This questionnaire focused on leafy greens and tomatoes and contained smaller sections on fruit, vegetables, and seafood common to the Delmarva region. Many patients were unreachable and did not receive the supplemental questionnaire. Sixty-two percent (49 of 79) of respondents reported eating cucumbers in the week before becoming ill. Patients were significantly more likely to report consuming cucumbers compared with respondents in the 2006–2007 FoodNet Population Survey, both for national year-round cucumber consumption (46.9% [p=0.002]) and for cucumber consumption in Maryland during the month of July (54.9% [p=0.04]). The proportion of ill persons who reported eating tomatoes, leafy greens, or any other item on the supplemental questionnaire was not significantly higher than expected compared with findings from the FoodNet Population Survey.

Traceback investigation

Officials in Maryland, Delaware, and New York worked with their FDA district offices and FDA and U.S. Department of Agriculture foodborne outbreak rapid response teams to conduct an informational (i.e., nonregulatory) traceback from retail establishments in these states to identify a point of distribution convergence for produce items (i.e., cucumbers, leafy greens, and tomatoes) consumed in nine of 12 subclusters. Each of eight establishments in Maryland and Delaware received cucumbers from a single major distributor. Preliminary traceback from the distributor to several brokers identified a common grower on Maryland's Eastern Shore in the Delmarva region. Traceback from a New York subcluster led to a different distribution chain than in Maryland and Delaware. Officials from the Maryland Department of Agriculture, the Maryland rapid response team, and the FDA Baltimore District Office visited the Maryland farm. Officials collected 48 environmental samples from areas where cucumbers were grown, harvested, and packed. Sediment and manure samples were taken from the farm. No samples yielded *Salmonella*; however, sampling was performed several months after the harvest. Records and interviews indicated that the farm applied poultry litter approximately 120 days before harvest, but it was not available for testing.

Laboratory investigation

Twelve distinct illness subclusters were identified across four states, ranging in size from two to six cases. WGS was performed on 58 clinical isolates by state health departments, FDA, and CDC laboratories to further characterize the genetic relatedness of bacteria isolated from patients. Phylogenetic analysis revealed a primary group of highly related clinical isolates from cases in Delaware, Maryland, Ohio, Pennsylvania,

and Virginia (median single nucleotide polymorphism distance = 26 [97.5% confidence interval = 1–37]). An additional group of highly related isolates from patients in New York was also identified, but this group was distinct from the primary phylogenetic group, consistent with the epidemiologic and traceback findings (single nucleotide polymorphism distance between the two phylogenetic groups = 102 [97.5% confidence interval = 85–114]). CDC's National Antimicrobial Resistance Monitoring System laboratory conducted antibiotic resistance testing on three isolates from ill persons with the outbreak strain. All three were susceptible to all antibiotics tested.

Discussion

The epidemiologic data, traceback investigations, and whole genome sequencing all support the hypothesis that cucumbers were a likely source of *Salmonella* Newport infections in this outbreak. Cucumbers were the only food eaten by patients significantly more often than expected. Traceback investigations performed using invoices from illness subclusters in Maryland and Delaware identified a common grower of cucumbers in the Delmarva region. This is the first multistate outbreak of *Salmonella* Newport implicating a fresh produce item grown in the Delmarva region other than tomatoes. Historically, *Salmonella* Newport outbreaks associated with this PFGE pattern have been linked to red round tomatoes grown on Virginia's Eastern Shore. These outbreaks occurred in 2002 (333 persons), 2005 (72 persons), 2006 (115 persons), and 2007 (65 persons), with an additional suspected outbreak in 2010 (51 persons) (1). A definitive contamination source has not been found, and *Salmonella* Newport has not been isolated directly from any Delmarva region tomatoes. Wildlife have been evaluated as a possible source of contamination, but fecal specimens from deer, turtles, and birds have been negative and do not support the hypothesis that animals are a source (2). Other serotypes of *Salmonella* have been linked to cucumbers; most recently an outbreak of *Salmonella* Saintpaul infections was linked to imported cucumbers from Mexico in 2013 (3).

Investigating illness subclusters can provide critical clues about the source of an outbreak. Informational traceback can support the epidemiologic investigation by quickly assessing the plausibility of one or more vehicles as the source of the outbreak. Informational traceback generally can be completed much more quickly than regulatory traceback, which requires the collection of specific types of records, such as receipts, invoices, and bills of lading, at each step of the distribution chain. In this investigation, the informational traceback quickly provided a critical clue that suggested cucumbers were a likely source in the outbreak. Consultation with independent industry experts early in an outbreak investigation also can provide important clues to help focus the investigation on certain suspected foods. Because of the suspicion that this outbreak was caused by a novel vehicle for this *Salmonella* Newport PFGE pattern, an industry consultation was held on September 11, 2014, with three independent experts from the produce industry to obtain information regarding cucumber harvesting and distribution on the Delmarva region. The consultants provided information regarding crop production and distribution practices that also helped assess the plausibility of cucumbers as an outbreak vehicle.

The findings in this report are subject to at least two limitations. First, no case-control study was performed because illness subclusters were small. Second, not all patients in the subclusters were systematically asked about cucumber consumption.

This outbreak supports the continued evaluation of farm practices by FDA as a part of the development of a Produce Safety Rule. These evaluations include conducting a risk assessment and working with the U.S. Department of Agriculture and other stakeholders. It also includes performing research to strengthen scientific support for determining appropriate intervals between application of raw manure fertilizer and harvest. The Maryland Department of Agriculture plans additional assessments in the Delmarva region before the 2015 planting season to determine whether additional or alternative "best practices" can be implemented.

Given the typical shelf life of cucumbers is 10–14 days, cucumbers from the implicated grower are no longer available for purchase or in person's homes. Consumers and retailers should always follow safe produce

handling recommendations. Cucumbers, like all produce, should be washed thoroughly, scrubbed with a clean produce brush before peeling or cutting, and refrigerated as soon as possible to prevent multiplication of bacteria such as *Salmonella*.

Source Article http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6406a3.htm?s_cid=mm6406a3_w

Case Study Questions

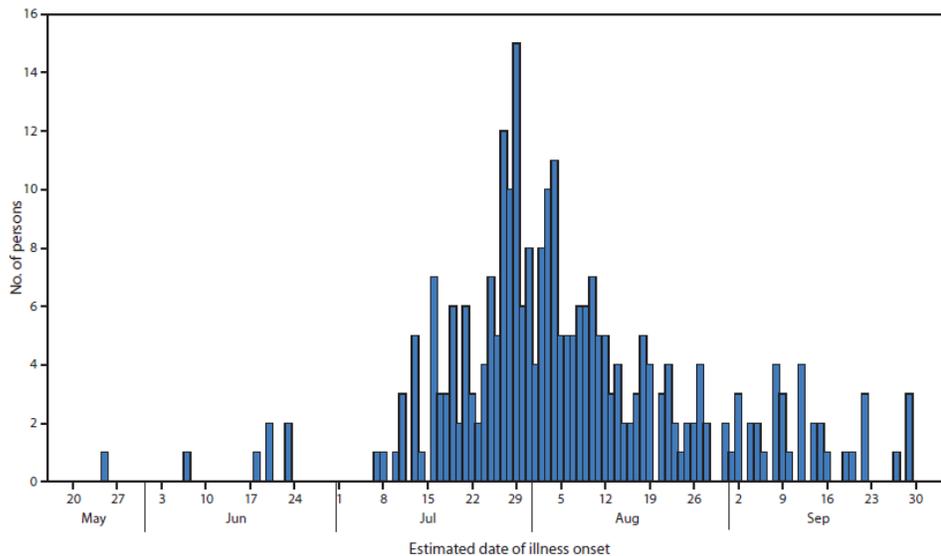
1. What is a case definition for *Salmonella* infection in this cluster?

2. What type of disease agent (organism) is *Salmonella* Newport?

3. What was the mode of transmission? (check all that apply)

- Direct transmission
- Indirect transmission
- Airborne
- Vector borne
- Vehicle borne

FIGURE Number of persons (N = 275) infected with the outbreak strain of *Salmonella* Newport, by estimated date of illness onset — United States, May 20–September 30, 2014



4. Epidemiologists show the time course of an epidemic by drawing a graph like the one above. What is the term used to describe this type of graph?

5. How many individuals met the case definition for this outbreak?

6. How was it determined that cucumbers were the most likely source of the outbreak (versus other fruits, vegetables and seafood common to the area)?

7. Once cucumbers were identified as the most likely source of the outbreak, investigators conducted a traceback investigation.
 - a. What was the goal of this investigation?

 - b. What steps did the epidemiologists take to complete this traceback investigation?

 - c. What conclusions did epidemiologists draw from the traceback investigation?

8. Why would a case-control study be more appropriate than a cohort study in studying the relationship between cucumbers and Salmonella infection in this cluster?

9. Would this case-control study be a prospective or retrospective study?

10. Often in a possible foodborne outbreak, epidemiologists calculate a *food-specific attack rate*. What formula would be used to calculate the food specific attack rate, or risk of illness, for people who ate cucumbers.