



# An Outbreak of Streptococcal Pharyngitis in Louisiana

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## Participant's Guide

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### Learning Objectives

After completing this case study, the participant should be able to:

- Define the terms *cluster*, *outbreak*, and *epidemic*,
- List the steps of an outbreak investigation,
- Create a case definition and explain its importance in an outbreak investigation,
- List five types of information to include in an outbreak questionnaire,
- Draw, interpret, and describe the value of an epidemic curve,
- Calculate food-specific attack rates and risk ratios,
- Use EPI INFO to perform basic descriptive analysis and cross-tabulations of epidemiologic data.

This case study is based on an investigation conducted in 1991 by the Louisiana Department of Public Health and Hospitals, and described in the following reference:

Farley TA, Wilson SA, Mahoney F, Kelso KY, Johnson DR, Kaplan EL. Direct inoculation of food as the cause of an outbreak of group A streptococcal pharyngitis. *J Infect Dis* 1993;167:1232-1235.

This case study developed in 1994 by Jeanette Stehr-Green and Richard Dicker. Current version updated by Richard Dicker.



## PART I

On May 16, 1991, a teacher at a private elementary school in Louisiana called the Epidemiology Section of the Louisiana Department of Public Health and Hospitals (LDHH) to report that a number of students and members of their families had become ill with

sore throat and/or cervical lymph node swelling ("swollen glands"). A few had been seen by their private physicians and had been diagnosed as having streptococcal pharyngitis, or "strep throat."

**Question 1:** What questions might you ask during the telephone conversation with the teacher?

While the LDHH epidemiologist was on the telephone with the teacher, she reached for her copy of *Control of Communicable Diseases*

*Manual* to review the basic clinical and epidemiologic aspects of streptococcal pharyngitis.

**Question 2:** List at least two on-line sources of information about the basic clinical and epidemiologic aspects of streptococcal pharyngitis. Does your assigned state have a fact sheet?

The private school had an enrollment of 355 children in kindergarten through 8th grade. On May 11, 1991, the school held a banquet at a local country club to honor students in the 5th through 8th grades who had participated in the sports program. Approximately 200 persons, including students, teachers, and family members, attended the banquet.

By May 16, twenty students and four family members, who had attended the banquet were known to have become ill. All ill persons

reported having sore throat. Eighteen reported having cervical lymphadenopathy ("swollen glands") and 16 reported having fever. Four of these persons had a positive throat culture or rapid antigen detection test for group A streptococci.

Based on school absentee records, about 1-2 students normally miss school each week due to streptococcal pharyngitis or similar illnesses. The number tends to increase in late winter and early spring.

**Question 3:** Do you think these cases represent an outbreak? Why?

LDHH decided to conduct an investigation. Two epidemiologists were dispatched to the school to initiate the investigation.

**Question 4:** List the steps of an outbreak investigation.

Persons with streptococcal pharyngitis frequently exhibit fever, sore throat, exudative tonsillitis or pharyngitis, and tender anterior cervical lymph nodes. Laboratory findings which support Group A streptococcal disease include identification of

group A streptococcal antigen in pharyngeal secretions (i.e., the rapid strep test) or isolation of organisms from the affected tissues on blood agar or other appropriate media.

**Question 5:** How would you define a case of group A streptococcal pharyngitis for the investigation? When might you want a relatively loose versus a relatively strict case definition?

## PART II

Epidemiologists from LDHH conducted a survey of the families of all children in the 5th-8th grades. Students were given questionnaires

and were asked to have their parents complete them with information on all household members.

**Question 6:** What information would you include in the questionnaire?

One hundred (82%) of the 122 households of children attending 5th-8th grades returned the questionnaire. Data from these questionnaires were entered into an EPI INFO data file named *school2*.

To answer Questions 7, 8, 10, and 11, use EPI INFO ANALYSIS to access the *xpharyngitis.mdb* file, then access the *school2* view. Appendix 1 includes a copy of the questionnaire and variable

names (in italics) used in *school2*. Persons meeting the case definition are indicated in the variable CASE. Appendix 2 provides a brief review of EPI INFO ANALYSIS commands.

**Question 7:** Using Epi Info and the *school2* data in the *xpharyngitis.mdb* file, generate the descriptive epidemiology of “person” for this outbreak.

(Suggestion: After reading file, click on the Set command. Be sure that “Include Missing” and “Show Percents” are clicked on; set “Statistics” to “Minimal”.)

At the very least,

- a. Review for yourself the variables included in the data set
- b. How many households are included in the data set? How many households had at least one case? Did any households have more than one case?
- c. Calculate the overall attack rate.
- d. Calculate attack rates by 5-year age group.
- e. Calculate attack rates by sex.
- f. Calculate attack rates by grade.

**Question 8:** Using Epi Info and the *school2* data in the *xpharyngitis.mdb* file, describe the clinical features of the cases in this outbreak.

**Question 9:** What is the value of an epidemic curve?

**Question 10a:** Draw an epidemic curve for this outbreak (either computer-generated or hand-drawn on graph paper is acceptable). Be sure it includes an appropriate title and axis labels. Mark the date of the banquet on the epidemic curve.

**Question 10b:** What proportion of cases had onset of symptoms 1–3 days after the banquet?

**Question 10c:** Describe and interpret your epidemic curve.

At this point, one of the two LDHH epidemiologists felt that there was sufficient evidence to associate the outbreak with the

school banquet. The other epidemiologist disagreed.

**Question 11:** Using Epi Info and the *school2* data in the *xpharyngitis.mdb* file, evaluate the hypothesis that attendance at the banquet was associated with strep pharyngitis. (Suggestion: Set Statistics to Intermediate.)

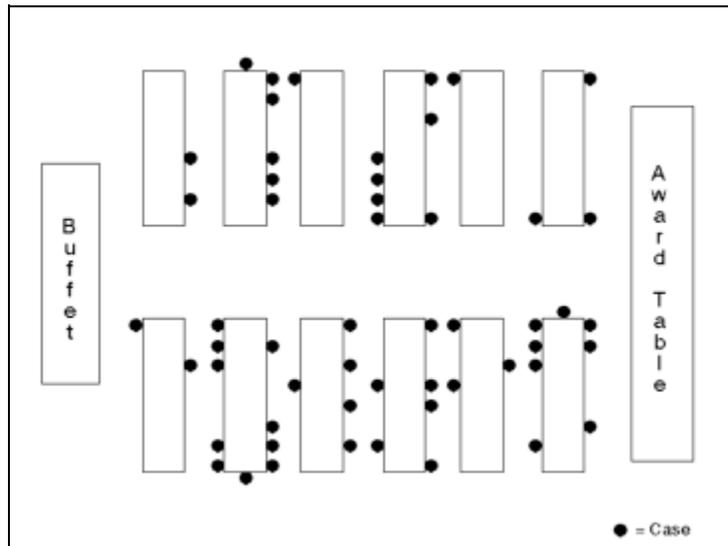
### PART III

The banquet consisted of a buffet meal catered by the local country club. The menu included a green salad, baked chicken, macaroni-and-cheese, green beans, rolls, beverages, and peach cobbler. Six foodhandlers were involved in preparing the food. Foodhandlers A, B, and C prepared the salad, rolls, and dessert. Foodhandlers E and F prepared the baked chicken and the green beans. Foodhandler D

prepared the macaroni-and-cheese and helped prepare the green beans. Five country club employees served the food to attendees from the buffet table between 7 P.M. and 9 P.M.

People were seated at the banquet according to personal choice. The diagram below shows where persons who became ill sat during the banquet.

Seating Location of Cases



**Question 12:** Review the modes of transmission for a communicable disease. What are the modes of transmission of group A streptococcal pharyngitis? Does person-to-person spread seem likely in this outbreak? Why or why not?

To investigate the source of infection at the banquet, only persons attending the banquet were included in the analyses. The case definition was modified to include only students and family members who attended the banquet and who had onset of illness from 1–3 days after the banquet.

Food histories among persons attending the banquet are provided in EPI INFO (*banquet*). Appendix 1 includes variable names used in *banquet*. Persons meeting the revised case definition are indicated in the variable CASE.

**Question 13a:** What type of study is this?

**Question 13b:** What is the appropriate measure of association for this type of study?

**Question 14:** Calculate attack rates, the appropriate measure of association, and 95% confidence intervals for each food item served at the banquet, and complete the following grid. (Suggestion: In Epi Info, set "Include Missing" to OFF; set "Statistics" to "Intermediate.")

Food item	ATE FOOD			DID NOT EAT FOOD			Measure of Association (and 95% CI)
	Ill	Total	Attack Rate	Ill	Total	Attack Rate	
Salad							
Baked chicken							
Macaroni-and-cheese							
Green beans							
Rolls							
Cobbler							
Tea							
Drinks							
Coffee							
Cream							

**Question 15:** Which food item(s), if any, is/are most suspect as the source? If two foods are suspected, determine the independent effect of each.

Blank area for writing the answer to Question 15.

**Question 16:** How might this (these) food item(s) have become contaminated?

**Question 17:** Outline further investigations or actions that should be undertaken.

## PART IV

Throat cultures were obtained from 24 students who attended the banquet and 15 who did not. Five (21%) of those who attended the banquet and none of those who did not had positive cultures for group A streptococci. Throat cultures from the six foodhandlers and five servers were negative. However, group A streptococci was cultured from a lesion on the hand of Foodhandler D. All six group A streptococci isolates (and an additional isolate provided by a parent who had attended the banquet) were found to be T-agglutination type 5/9, and either M-type 9 or OF-type 9.

Foodhandler D reported that he obtained the lesion in a barroom fight two weeks before the banquet. He treated the lesion with a topical ointment and covered it with a gauze bandage. The wound swelled for two days but then improved. The wound was covered with gauze while Foodhandler D prepared the macaroni-and-cheese.

The macaroni-and-cheese was prepared the day before the banquet. At 4 P.M., Foodhandler D warmed one gallon of milk and one gallon of cream on a stove. This mixture was then combined with cheese, corn starch, salt, pepper, and cooked macaroni noodles. The mixture was placed into five large "hotel pans" and stored in a walk-in refrigerator at 7 P.M. The next day, at 6 P.M., Foodhandler D took the pans out of the refrigerator and warmed them at 250°F for 45 minutes. He then stored the pans under heat lamps for one to two hours until they were served between 7 and 9 P.M. Foodhandler D agreed that throughout the preparation, the dish was never fully cooked.

Laboratory studies undertaken by Dr. Ed Kaplan at the University of Minnesota suggest that group A streptococci can survive and even multiply in macaroni-and-cheese made according to the above recipe as well as in a popular commercial brand.

**Question 18:** With whom would you share the results of the investigation?

**Question 19:** Refer to the following steps of an outbreak investigation. How well did this investigation conform to the list?

1. Identify potential investigation team and resources / Prepare for field work (e.g., administration, clearance, travel, contacts, designation of lead investigator, etc.)
2. Establish the existence of an outbreak / epidemic
3. Verify the diagnosis
4. Construct a working case definition
5. Find cases systematically, develop line listing
6. Perform descriptive epidemiology
7. Develop hypotheses
8. Evaluate hypotheses
9. As necessary, reconsider / refine hypotheses and execute additional studies
  - a. Additional epidemiologic studies
  - b. Other types of studies (e.g., laboratory, environmental)
10. Implement control and prevention measures (as early as possible)
11. Communicate findings
  - Summarize investigation for requesting authority
  - Prepare written report(s)
12. Maintain surveillance to monitor trends and evaluate control / prevention measures

## FURTHER READING

### Streptococcal Pharyngitis

- Farley TA, Wilson SA, Mahoney F, Kelso KY, Johnson DR, Kaplan EL. Direct inoculation of food as the cause of an outbreak of group A streptococcal pharyngitis. *J Infect Dis* 1993;167:1232-1235.
- Heymann D, ed. *Control of Communicable Diseases Manual*, 19<sup>th</sup> ed. Washington, DC: American Public Health Association, 2008.
- [http://wiki.medpedia.com/Strep\\_Throat](http://wiki.medpedia.com/Strep_Throat)

### Outbreak Investigations

- Dicker RC. *Principles of Epidemiology in Public Health Practice*, 3<sup>rd</sup> ed. Atlanta: Centers for Disease Control and Prevention, 2006.
- Goodman RA, Hadler SL, Vugia DJ. Operational aspects of epidemiologic investigations. In: Gregg MB, ed. *Field Epidemiology*, 3<sup>rd</sup> ed. New York: Oxford U. Press, 2008.
- Gregg MB. Conducting a field investigation. In: Gregg MB. *Field Epidemiology*, 3<sup>rd</sup> ed. New York: Oxford U. Press, 2008.

## APPENDIX 1 - QUESTIONNAIRE

A number of students from School X and their family members have developed an illness suggestive of strep throat. The Louisiana Department of Public Health and Hospitals has been asked by School X to investigate these cases. Please complete the following questions for each member of your family as part of this investigation. Use a separate form for each person. Fill in the blanks or circle the correct response for each question. Complete the entire form, even if the family member does not attend School X or has not become ill.

Name of family member: \_\_\_\_\_

Age: \_\_\_\_\_ Grade: \_\_\_\_\_ Sex: Male Female  
*(Age)* *(Grade)* *(Sex)*

In the last two weeks have you had any of the following symptoms:

Sore throat	Yes	No	<i>(Throat)</i>
Headache	Yes	No	<i>(Headache)</i>
Swollen lymph glands around your neck	Yes	No	<i>(Glands)</i>
Fever	Yes	No	<i>(Fever)</i>
Muscle aches	Yes	No	<i>(Aches)</i>
Stomachache	Yes	No	<i>(Stomach)</i>
Vomiting	Yes	No	<i>(Vomit)</i>

What day did your symptoms begin? \_\_\_\_\_ *(Date)*

Did you see a doctor regarding your illness?	Yes	No	<i>(MD)</i>
Did the doctor take a culture?	Yes	No	<i>(Culture)</i>
If yes, what were the results?	Positive	Negative	Unknown <i>(Results)</i>

Did you attend the School Sports Banquet held on May 11? Yes No *(Banquet)*

If yes, did you eat/drink any of the following items?

Salad	Yes	No	<i>(Salad)</i>
Baked chicken	Yes	No	<i>(Baked)</i>
Macaroni-and-cheese	Yes	No	<i>(Macaroni)</i>
Green beans	Yes	No	<i>(Beans)</i>
Rolls	Yes	No	<i>(Rolls)</i>
Cobbler	Yes	No	<i>(Cobbler)</i>
Tea	Yes	No	<i>(Tea)</i>
Drinks	Yes	No	<i>(Drinks)</i>
Coffee	Yes	No	<i>(Coffee)</i>
Cream	Yes	No	<i>(Cream)</i>

OFFICE USE ONLY	
Date Received:	
Case:	Yes No

\* EPI INFO variable names (for "school2.rec" and "banquet.rec") are included in italics.

## APPENDIX 2

### Epi Info 3.x — Brief Review of Common Analysis Commands

**READ (IMPORT)** is used to access a data file for analysis by selecting from list under **Views** (May need to **Change Project** first)

**LIST** produces a line listing of records. If you select **Allow Updates**, you can actually change the data.

**FREQUENCIES** counts each category for a specified variable and gives absolute and relative frequencies for each category.

**TABLES** performs cross tabulations of two or more variables. It will count the records in which values fulfill criteria for two or more fields at the same time.

**MEANS** calculates the mean, variance, standard deviation, median, and quartiles for numeric data.

**SORT** allows you to specify the sequence in which records will be written using the list command. If more than one variable is specified, the records will first be put in order by the first variable first, the second variable second, and so forth.

**SELECT** allows you to select a subset of records in a file based on the value of one or more selected variables.

**DEFINE** allows you to create new variables. The variable type and length are indicated after the variable name. Commands following the DEFINE command determine the value of the new variable.

Example: *DEFINE age10*

**ASSIGN** allows you to assign values (usually numeric) to a variable (usually to a newly defined variable)

Example: *ASSIGN age10 = 10 \* trunc(age/10)*

**IF** allows you to set the value of a one variable (often a newly defined variable) as a function of other variables. **ELSE** is a companion command if the conditions are not met.

Example: *Define agecat*

*IF age < 18 then agecat = "Child" ELSE agecat = "Adult"*

