

# Lunch on the Run: Using Photographs to Identify Possible Sources of Disease

**Resource Type:** Curriculum: Classroom

**Publication Date:** 9/24/2003

## Authors

*Rebecca Buxton*  
Department of Pathology  
University of Utah  
Salt Lake City, UT 84132  
USA  
Email: [rebecca.buxton@path.utah.edu](mailto:rebecca.buxton@path.utah.edu)

## Abstract

The activity was developed by members of Group B during the 2003 American Society for Microbiology Undergraduate Microbiology Education Conference. Contributors are: Beth Gaydos, Jonathan Kidd, Lucy Kluckhohn Jones, Donna Harrison Bennett, Pat Johnson, Hilda Merchant, Pamela Huber, Diane Nurko Hilker, Sandra Horikami, and Gary Kaiser.

Students are shown photographs of a family dining at an open air market. The photographs are captioned with personal information about the characters involved and the food and environment. The students answer questions to assess the situation for potential spread of infectious disease followed by a discussion of prevention methods and public health practices.

## Activity

**Invitation for User Feedback.** If you have used the activity and would like to provide feedback, please send an e-mail to [MicrobeLibrary@asmusa.org](mailto:MicrobeLibrary@asmusa.org). Feedback can include ideas which complement the activity and new approaches for implementing the activity. Your comments will be added to the activity under a separate section labeled "Feedback." Comments may be edited.

## INTRODUCTION

### Learning Objectives.

At the completion of this activity, students will be able to:

- Evaluate risk factors for food-borne infection or disease,
- Identify sources of food-borne infection or disease,
- List microbial pathogens causing food-borne infection or disease,
- Evaluate prevention methods, and
- Compare and contrast differences in public health practices.

### Background.

The students should have been provided instruction on the basics of disease transmission and possible sanitation practices outside the U.S. (or outside their immediate community).

## PROCEDURE

### Materials.

- [Student handout \(PDF\)](#) includes photographs and questions for discussion
- [Powerpoint of handout](#) includes captioned photos which can be projected during activity
- Photos (uncaptioned) for instructors who wish to customize the exercise: [Diners and their Lunch \(JPG\)](#) and [Fish Market](#)
- [Family tree](#)
- [Evaluation rubric](#)

Have available in the classroom:

- Text books, class notes, PubMed abstracts, internet access, or other resources on tropical disease transmission.

#### **Student Version.**

See attached [Student handout \(PDF\)](#) with questions.

With your group:

Observe the photographs and read the description of the situation. Then answer these questions:

1. Evaluate the possible risk factors for (at least) three persons.
2. Identify at least three sources of infection or food-borne disease.
3. Name five possible microbial pathogens lurking in (or near) this lunch, including the pictured item with which they might be associated. Include at least one protozoan and one virus.
4. What advice do you have for this family to avoid or prevent disease?
5. How would these pictures look different in your community? Why? Compare and contrast.

#### **Instructor Version.**

The exercise is designed for evaluation by small groups of students(three to five), followed by full class discussion.

- Give students copies of the handout.
- Show digital images or 8 by 10 inch copies of photographs.
- Describe scenario and include family biographies.
- Guide students to the questions on the handout.
- Instructors can vary biographies with different risk factors (e.g., pregnancy, transplant, diabetes, HIV, return from foreign travel or military service).
- Allow students time to discuss in small groups.
- Reconvene class.
- Provide information on disease in your local population as needed.

#### **Discussion.**

(Everything is true except the Emergency Medical Technician's pregnancy. We just couldn't pass up the cat connection! No one really got sick!) Discuss the questions on the handout. Discuss additional questions as time allows.

**Safety Issues.** None.

#### **ASSESSMENT AND OUTCOMES**

##### **Suggestions for Assessment.**

1. Oral or written review of responses.
2. Options for grade:
  - Attendance and participation
  - or
  - Score at instructor's discretion e.g., question(s) on next exam.
3. Example of Assessment: include instructions to the student groups to prepare a written report of the five questions to be scored by the attached [Evaluation rubric](#).

#### **SUPPLEMENTARY MATERIALS**

##### **Possible Modifications.**

Instructors are free to use as many of the discussion questions as are appropriate for their setting (see "Additional discussion questions" below).

Group discussions are suggested, but assignments could be individual or collaborative with or without discussions by the entire class.

The handout that is provided could take an entire class period depending on how specific the expected answers are for "risk factors" and "possible pathogens" and the resources available to answer the questions. The original photographs are also provided for the instructor to create a scaled-down version.

Since the activity is open-ended, many different microorganisms might be described as students develop this particular case. Clearly, not all classes will develop cases to the possible depths described in the activity. However, this is an asset for this activity. One possible pedagogical approach could be for students to build on past cases that prior students have developed. The instructor could keep a database of this and other similar cases and provide these to students as a possible starting point for discussions.

Another suggestion for modification would be for students to provide a different picture (family picnic, holiday gathering,

camping trip, or picture from a magazine) and biographies that could be used in the assignment. A set of case scenarios for future applications could be developed. Students could then critically evaluate disease risks in these case presentations. [See Patrick Field's article for information on student-generated case studies: **Field, P. R.** 2003. Senior seminar: using case studies to teach the components of a successful seminar. *J. Coll. Sci. Teaching* **32**(5):298-301.]

### References.

For excellent general information on food-borne disease, see the Center for Disease Control and Prevention's website:

<http://www.cdc.gov/travel/camerica.htm>  
<http://www.cdc.gov/travel/foodwater.htm>  
<http://www.cdc.gov/health/foodill.htm>  
<http://www.cdc.gov/foodsafety/>  
<http://www.cdc.gov/health/default.htm>

The National Center for Case Study Teaching in Science at the State University of New York at Buffalo may serve as a useful resource: <http://ublib.buffalo.edu/libraries/projects/cases>

The following abstracts may give useful background information. They are available on PubMed (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed>). Instructors may opt to print out a selection ahead of time to have on hand for student reference.

1. **Akinboade, O. A., J. O. Hassan, and A. Adejinmi.** 1984. Public health importance of market meat exposed to refuse flies and air-borne microorganisms. *Int. J. Zoonoses* **11**:111-114.
2. **Barro, N., C. A. Ouattara, P. A. Nikiema, A. S. Ouattara, and A. S. Traore.** 2002. Microbial quality assessment of some street food widely consumed in Ouagadougou, Burkina, Faso. *Sante* **12**:364-374.
3. **Basanez, M. G., R. C. Collins, C. H. Porter, M. P. Little, and D. Brandling-Bennett.** 2002. Transmission intensity and the patterns of *Onchocerca volvulus* infection in human communities. *Am. J. Trop. Med. Hyg.* **67**:669-679.
4. **Chitwood, M.** 1975. *Phocanema*-type larval nematode coughed up by a boy in California. *Am. J. Trop. Med. Hyg.* **24**:710-711.
5. **Debord, T., and Y. Buisson.** 1998. Viral hepatitis of enteric origin. *Bull. Soc. Pathol. Exot.* **91**:428-431.
6. **Dias, J. C., A. C. Silveira, and C. J. Schofield.** 2002. The impact of Chagas disease control in Latin America: a review. *Mem. Ins. Oswaldo Cruz.* **97**:603-612.
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8. **Farkas, T., X. Jiang, M. L. Guerrero, W. Zhong, N. Wilton, T. Berke, D. O. Matson, L. K. Pickering, and G. Ruiz-Palacios.** 2000. Prevalence and genetic diversity of human caliciviruses (HuCVs) in Mexican children. *J. Med. Virol.* **62**:217-223.
9. **Fernandez Escartin, E., and M. R. Torres Vitela.** 1996. Contamination of fish ceviche by *Salmonella* in Guadalajara, Jalisco, Mexico. *Bol. Oficina Sanit. Panam.* **120**:198-203.
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11. **Hauck, A. K.** 1977. Occurrence and survival of the larval nematode *Anisakis* sp. in the flesh of fresh, frozen, brined, and smoked Pacific herring, *Clupea harengus pallasi*. *J. Parasitol.* **63**:515-519.
12. **Hutchinson, J. W., J. W. Bass, D. M. Demers, and G. B. Myers.** 1997. Diphyllbothriasis after eating raw salmon. *Hawaii Med. J.* **56**:176-177.
13. **Khan, A. R., and F. Huq.** 1978. Disease agents carried by flies in Dacca city. *Bangladesh Med. Res. Council. Bull.* **4**:86-93.
14. **Kuhlhorn, F.** 1987. The flight of dipterans from cat feces and its possible hygienic significance. *Angew Parasitol.* **28**:93-101.
15. **Leclerc, H., L. Schwartzbrod, and E. Dei-cas.** 2002. Microbial agents associated with waterborne diseases. *Crit. Rev. Microbiol.* **28**:371-409.
16. **Lee, S. H., and S. J. Kim.** 2002. Detection of infectious enteroviruses and adenoviruses in tap water in urban areas in Korea. *Water Res.* **36**:248-256.
17. **Le Guyader, F., L. Haugarreau, L. Miossec, E. Dubois, and M. Pommepuy.** 2000. Three-year study to assess human enteric viruses in shellfish. *Appl. Environ. Microbiol.* **66**:3241-3248.
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20. **Mensah, P., D. Yeboah-Manu, K. Owusu-Darko, and A. Ablordey.** 2002. Street foods in Accra, Ghana: how safe are they? *Bull. World Health Organ.* **80**:546-554.
21. **Munoz de Chavez, M., A. Chavez Villasana, M. Chavez Munoz, and I. Eichen Vuskovic.** 2000. Sale of street food in Latin America. The Mexican case: joy or jeopardy? *World Rev. Nutr. Diet.* **86**:138-154.
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23. **Olsen, A. R.** 1998. Regulatory action criteria for filth and other extraneous materials. III. Review of flies and foodborne enteric disease. *Regul. Toxicol. Pharmacol.* **28**:199-211.
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25. **Redlinger, T., V. Corella-Barud, J. Graham, A. Galindo, R. Avitia, and V. Cardenas.** 2002. Hyperendemic *Cryptosporidium* and *Giardia* in households lacking municipal sewer and water on the United States-Mexico border. *Am. J. Trop. Med. Hyg.* **66**:794-798.
26. **Rodrigues, A., H. Brun, and A. Sandstrom.** 1997. Risk factors for cholera infection in the initial phase of an epidemic in Guinea-Bissau: protection by lime juice. *Am. J. Trop. Med. Hyg.* **57**:601-604.
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gastric anisakiasis. Dig. Dis. Sci. **38**:1354-1356.

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## Appendices and Answer Keys.

### Possible Answers

1. Possible risk factors, including, but not limited to:

- Age (grandfather)
- Steroid drugs (grandfather)
- Pregnancy (emergency medical technician)
- Diabetes (big sister)
- Overweight (big sister)
- Foreign travel (big sister)
- Wilderness travel (little sister)

2 and 3. Possible sources and associated organisms, including, but not limited to:

- Fresh vegetables and guacamole: *Salmonella*, *Shigella*, *Escherichia coli*, *Cryptosporidium*, *Bacillus cereus*, *Cyclospora*, *Entamoeba*.
- Water: *E. coli*, hepatitis A, Norwalk, rotavirus, enteroviruses (polio, etc.), *Giardia*, *Vibrio cholera*.
- Grape soda: very low risk of contamination. (Good choice!)
- Cheese: *Brucella*, *Listeria*, *Staphylococcus aureus*.
- Fried fish and shrimp: might get *Vibrio* as an answer, but, having been fried and served immediately, the seafood should be pretty safe.
- Sea birds: fecal contamination of ground water (*Salmonella*, *Shigella*, marine *Vibrio*).
- Sea mammals: can carry *Leptospira*, *Brucella*, hookworms, and a variety of fungi, but risk is low unless you go in the water or to a place where they beach.
- Samples of smoked tuna in the market: *Staphylococcus aureus*, *Bacillus*, (etc., from dust, flies, food handlers, and passers by), *Anisakis* and other helminth parasites of raw fish (stress how poorly smoking ...and freezing ...kill helminth parasites). (*Diphyllobothrium* would be a reasonable guess, but not reported in tuna.)
- Limes: some evidence of partial protection from bacterial agents.
- Puddles of standing water in the market: *Leptospira*\* (if possible rat urine or marine mammal contamination), possible *Plasmodium*\*, yellow fever\*, encephalitis viruses, Dengue\* (if mosquitoes and larvae present).
- Cats: *Toxoplasma*.
- Flies and garbage dump: *Salmonella*, *Shigella*, *E. coli*, *Aeromonas*, various parasites possible such as *Ascaris*, *Trichuris*, hookworm, *Enterobius*, *Entamoeba*, *Giardia*.

\*These are far-fetched, but not wrong.

4. Advice for preventing disease transmission:

- Don't drink the tap water or ice-containing beverages (made from tap water).
- Purchase or bring bottled water or other bottled drinks, such as soft drinks.
- Eat indoors where vectors are less obviously present.
- Use nonwater (alcohol) hand washing before meals.
- Eat only foods that have been cooked and are still hot when served.
- Ask if they keep their perishable foods refrigerated or on ice. Get suggestions of restaurants to eat at. (Ask the hostel where the cleanest restaurants are for visitors.)
- Take a quick look in the kitchen if possible. Watch how servers handle other food.

### Additional Discussion Questions

- Do you think anyone washed their hands? (well...actually, no.)
- Do you think sanitary water was available for hand washing? (Public toilets required a quarter for entry. Status of tap water unknown...probably the same as what Grandpa was drinking!)
- What do you think is the possible role of other "unseen" vectors and reservoirs in this situation? (like rats, fleas from rats and cats, and mosquitoes)
- In what scenarios in your community might similar food safety conditions exist? (fairs, large picnics or outdoor gatherings, camping trips, illegal street vendors)
- Do you think the lime juice had time to show any effect as an antimicrobial agent?
- These are ALL science-educated people! Discuss how **knowledge** of a hazardous situation affects (or fails to affect) a person's actual **behavior**.

## Lunch on the Run

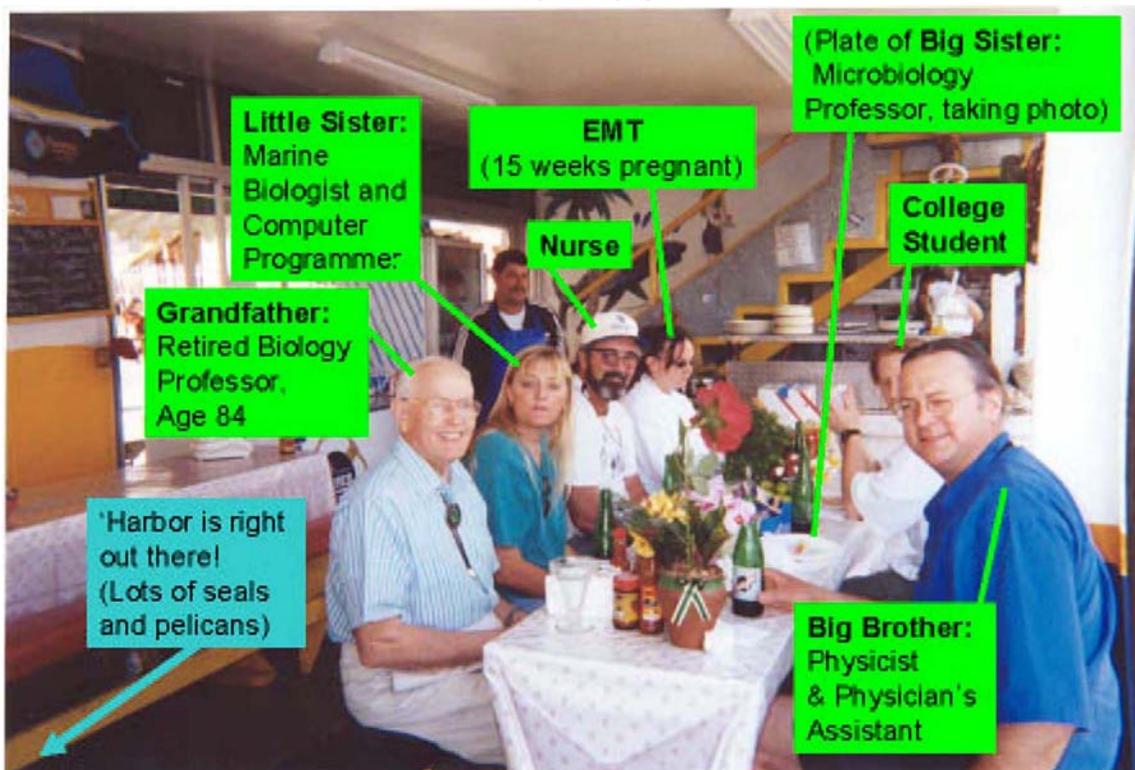
Below you will see several photographs of a family who has traveled to a coastal location south of the U.S. border. The seven persons pictured include:

- **Grandfather**, age 84. Retired biology professor in excellent health. Suffers from osteo-arthritis and takes low dose steroids and other non-steroidal anti-inflammatory drugs. Home is in North Carolina. Has been hiking and camping all his adult life.
- **Little sister**, age 45. Undergraduate degree in marine biology. Many years experience as a computer programmer. Addicted to the out-of-doors. Actively involved with the Sierra Club in southern California. Likes to discover uncharted waterfalls in wilderness areas. ("Guide" for this trip.)
- **Nurse**, age 50. Little sister's boyfriend. Works with abused children in a group home. Raised in Montana. Loves to fish. Part Native American.
- **Emergency medical technician**, age 28. Daughter of little sister's boyfriend. Raised in southern California. Trained as a firefighter. Active duty military. 15 weeks pregnant.
- **College student**, age 20. Interested in computers. Son of little sister. Speaks Spanish. Goes to college in North Carolina. Recently drove all the way home to California.
- **Big sister**, age 50. (Not pictured, is taking pictures.) Many years experience in clinical microbiology. Currently teaching microbiology at a university in Utah. Slightly overweight. Family history of diabetes. Recently facilitated a microbiology workshop in Bucharest, Romania.
- **Big brother**, age 52. Undergraduate degree in physics. Also trained as a Physician's Assistant. Currently owns and operates a concrete cutting business in Seattle for which he designs and manufactures blades. Does lots of heavy lifting.

The family has spent time observing the activity in this harbor town—watching people feed birds and sea animals and wandering through the fish market. (You must appreciate the artful towers of shrimp!) The nurse was the only one who accepted the free sample of smoked tuna. Hot and thirsty, they all sat down at an open-air café for fish tacos.

1. Evaluate possible risk factors for (at least) three persons.
2. Identify at least three sources of infection or food-borne disease.
3. Name five possible microbial pathogens lurking in (or near) this lunch, including the pictured item or risk factor with which they might be associated. Include at least one protozoan and one virus.
4. What advice do you have for this family to avoid or prevent disease?
5. How would these pictures look different in your community? Why? Compare and contrast.

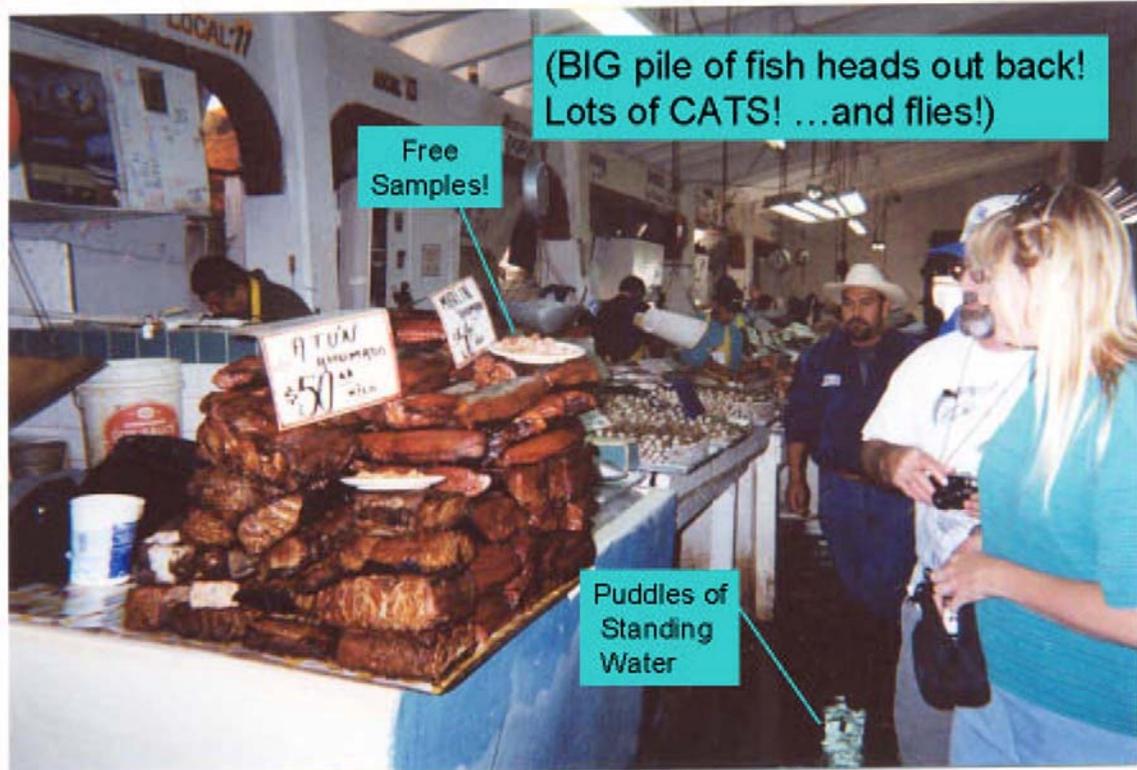
## The Diners

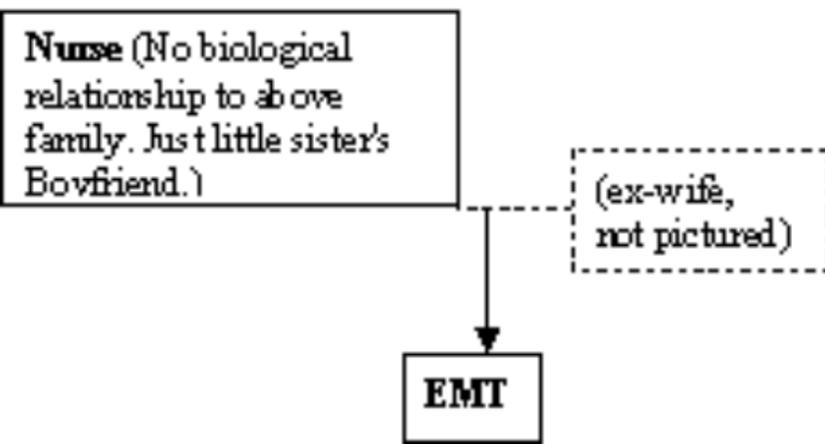
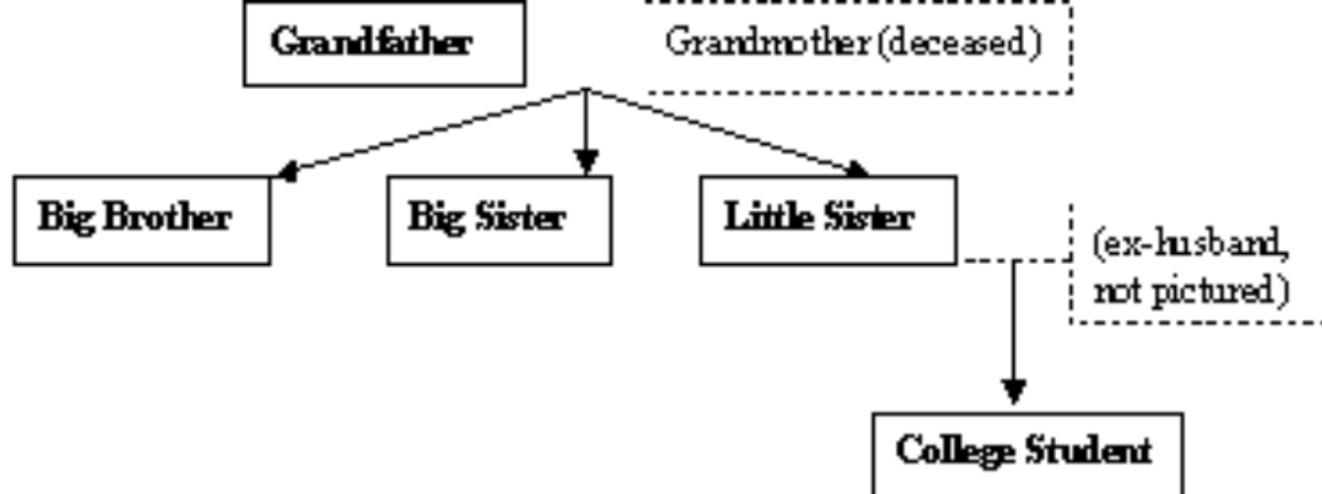


## The Lunch



## The Market





 Curriculum Resources

## "Lunch on the Run" Evaluation Rubric

The total score will be a sum of points out of a possible 20 points converted to a percentage. For example, scores of 4, 3, 3, 4, 2 would give a total of 16, or 80%.

Points <sup>®</sup> Question	4	3	2	1	0
1. Risk factors	Complete and accurate; three persons listed with risk factors appropriate to description of person	Two persons with risk factors appropriate to description of person	One person with risk factors appropriate to description of person	Effort made; no appropriate or accurate information	No effort No answer No credit
2. Sources of infection	Three appropriate sources listed	Two appropriate sources listed	One appropriate source listed	Effort made; no appropriate sources listed	No effort No answer No credit
3. Pathogens	Five reasonable organisms listed, including one virus and one protozoan	Three to four reasonable organisms listed, including one virus and one protozoan	One to two reasonable organisms listed	Effort made; organisms not consistent with case presented	No effort No answer No credit
4. Disease prevention	A paragraph discussing three prevention strategies.	A paragraph discussing two prevention strategies.	A paragraph discussing one prevention strategy.	Effort made; strategies not appropriate to case presented	No effort No answer No credit
5. Public health practice	A paragraph comparing and contrasting at least three differences between public health and sanitation standards in home community with this developing world setting.	A paragraph comparing and contrasting two differences between public health and sanitation standards in home community with this developing world setting	A paragraph comparing and contrasting one difference between public health and sanitation standards in home community with this developing world setting	Effort made; differences not appropriate to case presented or to home community	No effort No answer No credit

