



FOCUS on Field Epidemiology

CONTRIBUTORS

Author:

FOCUS Workgroup*

Reviewers:

Amy Nelson, MPH

J. Newt MacCormack, MD, MPH**

FOCUS Workgroup*

Production Editors:

Lorraine Alexander, DrPH

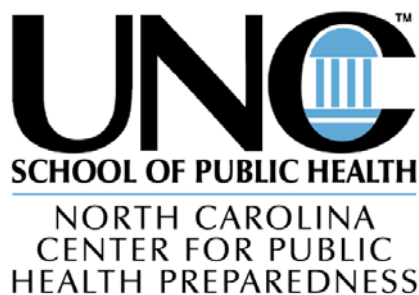
Gloria C. Mejia, DDS, MPH

Editor in Chief:

Pia D.M. MacDonald, PhD, MPH

* All members of the FOCUS workgroup are named on the last page of this issue.

** Associated with the North Carolina Division of Public Health



The North Carolina Center for Public Health Preparedness is funded by a cooperative agreement between the Centers for Disease Control and Prevention and the Association of Schools of Public Health, Project # A1011-21/21

Anatomy and Physiology of an Outbreak Team

What's in a team? What makes it tick? What determines how well it functions? We could start with familiar examples, such as a football team. The sly and quick quarterback must be fast on his feet and make sure the other players know what their jobs are; and then there are the pummeling linemen, massive linebackers, and the kicker, who makes a guest appearance when necessary.

There are also news teams, which have a unique way of functioning. A news team usually involves two people sitting dry, comfy, and warm at the news desk, while half a dozen reporters and camera crews are scattered up and down the coastline in gale-force winds, showing you pictures of siding blowing off houses. "Well, Jim," yells the field reporter, "the wind is really picking up here on the coast. The last reading had gusts up to 90 miles per hour. This is no place for people to be out and about! But don't worry, the camera guy and I are tethered to the sea wall, so we can give you continuing coverage throughout the hurricane..."

Then there is everyone's favorite team from the 1980's: The Ghostbusters. There's the nerdy looking guy with such a big brain that he can figure out how to suck ghosts up with a vacuum cleaner, the tough guy who is always the first one to go up against the newest, creepiest threat (and who gets the girl), and the funny guy who is the first one to get covered in ghosty ooze in any given ghost-busting situation.

The point here (yes, there is a point), is that every team has a unique way of operating, depending on their ob-

jectives. They function as one unit, one organism, if you will. An outbreak investigation team is no different. Except that, if you are lucky, there will be no tackles, no gale force winds, and minimal mysterious ooze.

Successful outbreak investigations require a multidisciplinary approach with effective communication and collaboration. In this issue of FOCUS, we will discuss the anatomy and physiology of an outbreak investigation team.

In the previous FOCUS issue, we presented the steps of an outbreak investigation. Deciding to investigate is the crucial early step. Availability of resources and trained personnel should factor into this decision, especially since the direct costs of an investigation are considerable. Once the decision to investigate is made, the team leader will then begin to assemble team members. The team leader may be selected as a result of the outbreak setting or etiologic agent. For example, a foodborne outbreak in a hospital cafeteria could be led by infection control personnel in the hospital, while an outbreak at a wedding reception will likely be the responsibility of the local health department.

Initially, the investigation may be led by an epidemiologist or clinician who will assume responsibility for the first stages of the outbreak (verifying the diagnosis and existence of the outbreak). Personnel will likely be added as the outbreak progresses, but availability of trained personnel should factor into the decision to

investigate. Ideally, the team leader will assemble the team, present available information, outline the plan for investigation, and assign roles and responsibilities to the team members early in the investigation.

Questions to keep in mind as the outbreak unfolds

1. What resources, including personnel, are available?
2. What resources could be provided by outside collaborators?
3. Who will direct the day-to-day investigation?
4. Who will interface with the media?
5. How will the team communicate with each other?
6. How will data be shared and analyzed?
7. Who will write final report and present the information?

Team member roles

The **team leader** should have experience in outbreak investigation and public health epidemiology. Depending on the size and organization of the health department, this could be the local health director, public health nurse, epidemiologist, or environmental health specialist.

The **epidemiologist** has expertise in various aspects of outbreak investigations, from choosing the study design and questionnaire development to creating a database and conducting data analysis. A **microbiologist**, usually at a state or regional public health laboratory, will be important in verifying the diagnosis and subtyping of pathogens to help refine a case definition. For example, in a foodborne illness outbreak, isolates of bacterial pathogens such as *Salmonella* or *Listeria monocytogenes* can be further characterized using pulsed-field gel electrophoresis, or PFGE, at the state public health laboratory. These PFGE patterns can be compared to see if cases are related to the outbreak and shared nationally to see if the outbreak is widespread (1).

Environmental health specialists (EHS) or sanitarians are important in preventing foodborne outbreaks from occurring through routine inspections of food preparation facilities, health education, and training of foodhandlers. However, once an outbreak occurs, sanitarians are able to identify food safety issues that may have contributed to the outbreak, such as time and temperature violations, and can assist in proper collection of food and environmental samples. An EHS may also provide guidance on food safety regulations and engineering during the outbreak.

During any analytic study, **interviewers** will be used to collect data, either in person or by telephone. Interviewers can come from the ranks of the health department personnel, including clerical support staff; in large outbreaks, state or federal personnel or students in medicine or public health may be recruited to conduct interviews.

Clinicians are also an important part of the outbreak team. For example, during an outbreak of hepatitis A, clinicians are necessary to administer immunoglobulin or vaccine to contacts of infected individuals. These clinicians may come from the health department or the local medical community (2). Clinicians may also assist in collection of clinical specimens from case-patients. Zoonotic outbreaks may involve veterinarians and other scientists, such as entomologists, to provide expertise in animal reservoirs or vectors.

Regulators from state or federal agencies may be included on the outbreak team to help facilitate identification of the source of contaminated food items and develop prevention strategies through enforcement of food safety regulations.

Unusual outbreak situations call for unusual collaborations. For example, ongoing cases of wound botulism in California were associated with subcutaneously or intramuscularly injecting black tar heroin (3). In a case-control study of wound botulism, investigators called on expertise in California Department of Alcohol and Drug programs and drug enforcement officials. Collaboration between public health and **law enforcement** became increasingly important after intentional releases of anthrax in 2001 (4).

Finally, one team member should act as the **media spokesperson** for the outbreak team to make sure that clear and consistent messages are disseminated to the community. This is especially important if the outbreak is ongoing or there is anxiety among the public, such as during a suspected bioterrorism event.

Team equipment

Although properly trained personnel are crucial to the success of an outbreak investigation, proper equipment is also necessary. Health departments should have a functioning computer with access to the internet for email and literature searches through PubMed. Epi Info is a software package that is useful for entry and analysis of epidemiologic data; it is available for free from the Centers for Disease Control and Prevention (CDC) website (see: <http://www.cdc.gov/epiinfo/>).

The CDC's Foodborne and Diarrheal Disease website also offers helpful guidelines for confirming the diagnosis, specimen collection, and a sample questionnaire for use in specimen collection for foodborne disease outbreaks

(see: http://www.cdc.gov/foodborneoutbreaks/outbreak_toolkit.htm). Equipment useful to have in a local health department for specimen collection include a cooler to transport specimens, rectal swabs or specimen cups to collect specimens, and phlebotomy equipment for collecting blood samples.

Communication

During outbreak investigations, keeping the lines of communication open through regular meetings or phone calls is crucial. Team leaders should receive regular updates to measure progress in the investigation; they should use this information to provide feedback and direction to the team members. Documentation of progress is important for keeping all team members up to date and helpful for drafting the final report. Leaders should make task checklists and assign specific roles and responsibilities to team members. One person from the team should be designated as the media contact to ensure that a consistent message with correct information is transmitted to the public.

Increasingly, foodborne disease outbreaks occur in multiple jurisdictions. Management of these outbreaks relies on communication among local, state, and federal public health agencies (5). As highlighted by the recent Severe Acute Respiratory Syndrome (SARS) outbreak, the Internet is an important tool to keep collaborators informed for diagnosis, treatment, and control of the disease (6).

Case studies

Listeriosis among Hispanic women in Winston-Salem, NC

In 2000, three cases of listeriosis were reported to the Forsyth County Health Department within a two week period (7). A case was defined as laboratory-confirmed *Listeria monocytogenes* in a mother of a stillborn or premature infant or a mother with a febrile illness who was a Winston-Salem resident during the period from October 24, 2000, through January 1, 2001. Through active case finding, an additional eight cases were identified. All case-patients were born in Mexico and did not speak English. A case-control study was conducted, using age- and pregnancy status-matched Hispanic women identified at the county Women, Infant, and Children (WIC) office or the state prenatal care program (Baby Love) as controls. The results of the study implicated consumption of queso fresco, a Mexican-style soft cheese made from raw (unpasteurized) milk. Environmental Health Specialists made inspections of case-patient homes, local markets, and dairy farms to identify possible sources of contamination and potential intervention strategies. Milk and cheese samples were collected, and some tested positive for *L.*

monocytogenes with identical molecular subtype (PFGE) patterns to the case-patient isolates. Education campaigns were conducted to reduce the consumption of queso fresco, especially among high risk groups, and to reduce the illegal sale of raw milk and raw milk products among farmers and grocers.

This outbreak shows the benefit of collaboration among local, state, and federal public health and regulatory agencies. The investigation included the participation of the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Agriculture and Consumer Services, and veterinarians from North Carolina State University. The difficulties of conducting a case-control study among foreign-born non-English speakers are also important to note. The team needed to translate a questionnaire and train interviewers to administer the survey in Spanish. As a result of this outbreak, *L. monocytogenes* infection was added to the list of reportable conditions in North Carolina.

Tuberculosis in a homeless shelter in Raleigh, NC

A cluster of nine cases of tuberculosis was identified in Wake County, North Carolina in March and April 2000 (8). The common risk factor was spending the night in a large urban homeless shelter. Investigation of the shelter included on-site screening by tuberculin skin test and radiograph, followed by directly observed therapy for infected individuals. This investigation involved collaboration with law enforcement to obtain records of incarceration, microbiologists to conduct spoligotyping and restriction fragment length polymorphism (RFLP) subtyping analyses of *Mycobacterium tuberculosis* isolates, industrial hygienists to inspect the homeless shelter and make specific recommendations to improve ventilation, and public health nurses to screen and treat persons identified in the exposed cohort at this homeless shelter.

To explore the challenges of a similar investigation, see the published teaching module, *Outbreak of Tuberculosis in a Homeless Men's Shelter* (9)

Conclusion

It has been said that epidemiology is a team sport. Working as a team during an outbreak investigation requires a wide range of expertise, clear communication, and dedication to the principle that an outbreak is a public health emergency that requires a rapid but careful and systematic approach to identifying the source(s) of the outbreak and prevent further human illness.

THE UNIVERSITY OF NORTH CAROLINA

North Carolina Center for Public Health Preparedness
The University of North Carolina at Chapel Hill
Campus Box 8165
Chapel Hill, NC 27599-8165

Phone: 919-843-5561
Fax: 919-843-5563
Email: nccphp@unc.edu

FOCUS Workgroup:

- Lorraine Alexander, DrPH
- Jill Koshiol, MSPH
- Pia D.M. MacDonald, PhD, MPH
- Gloria C. Mejia, DDS, MPH
- Sally B. Mountcastle, MSPH
- Amy Nelson, MPH
- E. Danielle Rentz, MPH
- Tara P. Rybka, BA
- Cheryl R. Stein, MSPH
- Michelle Torok, MPH
- Nicole Tucker, MPH
- Drew Voetsch, MPH

REFERENCES

1. Swaminathan B, Barrett TJ, Hunter SB, Tauxe RV. PulseNet: the molecular subtyping network for foodborne bacterial disease surveillance, United States. *Emerg Infect Dis* 2001;7(3):382-9.
2. Frace RM, Jahre JA. Policy for managing a community infectious disease outbreak. *Infect Control Hosp Epidemiol* 1991;12(6):364-7.
3. Werner SB, Passaro D, McGee J, Schechter R, Vugia DJ. Wound botulism in California, 1951-1998: recent epidemic in heroin injectors. *Clin Infect Dis* 2000;31(4):1018-24.
4. Butler JC, Cohen ML, Friedman CR, Scripp RM, Watz CG. Collaboration between public health and law enforcement: new paradigms and partnerships for bioterrorism planning and response. *Emerg Infect Dis* 2002;8(10):1152-6.
5. Sobel J, Griffin PM, Slutsker L, Swerdlow DL, Tauxe RV. Investigation of multistate foodborne disease outbreaks. *Public Health Rep* 2002;117(1):8-19.
6. Drazen JM, Campion EW. SARS, the Internet, and the Journal. *N Engl J Med* 2003;348(20):2029.
7. Outbreak of listeriosis associated with homemade Mexican-style cheese—North Carolina, October 2000-January 2001. *MMWR Morb Mortal Wkly Rep* 2001;50(26):560-2.
8. McElroy PD, Southwick KL, Fortenberry ER, Levine EC, Diem LA, Woodley CL, et al. Outbreak of tuberculosis among homeless persons coinfecting with human immunodeficiency virus. *Clin Infect Dis* 2003;36(10):1305-12.
9. Morrow CB, Cibula DA, Novick LF. Outbreak of tuberculosis in a homeless men's shelter. *Am J Prev Med* 2003;24(4 Suppl):124-7.

UPCOMING TOPICS!

- Embarking on an Outbreak Investigation
- Introduction to Forensic Epidemiology
- Case Finding and Line Listing: a Guide for the Investigator
- Epidemic Curves Ahead
- Hypothesis Generation

If you would like to receive electronic copies of Focus on Field Epidemiology periodical please fill out the form below:

- NAME: _____
- DEGREE (S): _____
- AFFILIATION: _____
- E-MAIL ADDRESS: _____
- May we email any of your colleagues? If so, please include their email here:

Please fax to: (919) 919-843-5563

or mail to: North Carolina Center for Public Health Preparedness
The University of North Carolina at Chapel Hill
Campus Box 8165
Chapel Hill, NC 27599-8165

Or go on-line: <http://www.sph.unc.edu/nccphp/focus/form1.cfm>

We are on the web!
<http://www.sph.unc.edu/nccphp>