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FOODBORNE OUTBREAK INVESTIGATION: HOW DO I FIND THE IMPLICATED FOOD WHEN I HAVE FEW CASES AND NO GOOD HYPOTHESIS?

By Jonathan Yoder, M.S.W., M.P.H., Kathy Ritger, M.D., M.P.H., and Mark S. Dworkin M.D., M.P.H.T.M.

During late July to mid-August 2005, 10 residents of Winnebago and Ogle counties in north central Illinois had onset of diarrhea and abdominal cramping caused by *E. coli* O157:H7. Routine molecular testing at the Illinois Department of Public Health Division of Laboratories showed all of these isolates had identical pulsed-field gel electrophoresis (PFGE) patterns, indicating a common exposure. All 10 cases were unrelated, and the majority resided in the city of Rockford. Initial case interviews performed by the two local health departments revealed that most cases ate ground beef during their incubation period, but there was no common source of the beef, such as a restaurant, a particular grocery store or a butcher. Additionally, no other common food item or exposure was evident.

Ultimately, most cases (7 of 10) were re-interviewed and asked more detailed questions about their consumption of beef food items, consumption of foods from a wider variety of sources (e.g. concessions stands, gas stations and convenience stores, roadside stands, farmers' markets and ready-to-eat foods from grocers), and patterns of travel through Rockford. Again, no commonalities could be identified among the cases. A case-control study was designed and began collecting data, then revised and began collecting additional data, and ultimately suspended because no clear hypothesis of the sources of the outbreak had emerged. Surveillance data demonstrated that the outbreak had terminated by October so the investigation ended.

This *E. coli* O157:H7 outbreak raised questions about how to proceed in a community outbreak setting. After completion of the initial case reports, it may be tempting to develop a case control questionnaire and attempt to implicate a food by interviewing cases and controls about every restaurant, grocery store or event mentioned in the initial interviews. However, case-control studies should be launched based upon a sound hypothesis, in order to have the greatest chance for implicating the source of the outbreak.

During the investigation, we came across a memorandum circulated internally at the U.S. Centers for Disease Control and Prevention (CDC) during March 1984 in which CDC epidemiologists, including Dr. Paul Blake, discussed the utility of analytic studies (such as a case-control study) in outbreak investigations when a hypothesis was not readily apparent. Their approach was based on years of outbreak investigation experience and is especially applicable to outbreaks of apparently sporadic disease, such as from *E. coli* O157:H7, rather than a cohort, such as a church supper outbreak.

The CDC memo emphasized the importance of confirming that an outbreak truly exists before proceeding with an investigation. Following confirmation, it stressed the importance of intensively interviewing the initial cases to attempt to determine what common thread exists between them. If the case interviews fail to lead to a hypothesis about the exposure, the interviews could be repeated by a more experienced interviewer. As a last resort, the cases could be brought together as a group to discuss possible exposures. The group setting could uncover patterns and interconnections that were not evident in the individual interviews. This step would require additional effort by the investigators and consent by all the cases involved and might be performed in person or by conference call. However, if the investigators believed that the interview process had been comprehensive, but they still had no

hypothesis, there would be little value in proceeding to a case-control study at that point in the investigation.

We contacted Dr. Blake, who has since retired from CDC and the Georgia Department of Public Health, to discuss this important aspect of outbreak investigations. In his experience, in-depth case interviews are indispensable building blocks of the outbreak investigation. This approach has led to the discovery of "unusual" vehicles of disease not previously considered important for certain pathogens. For example, he discussed his investigation of an outbreak of cholera in Louisiana [1].

> *"It was not until I interviewed the fourth case and he mentioned eating cooked crabs which the first three had also mentioned, that a chill went up my spine and I thought 'cooked crabs could be the cause of this outbreak.' We would never have otherwise included cooked crabs on a case control questionnaire because we did not consider cooked crabs to be a possible vehicle for cholera because they were cooked."*

His opinion is that a single investigator, if possible, should interview each of the initial case-patients intensively by systematically exploring all possible exposures within the incubation period for the particular disease. He/she will ask standard exposure questions as well as ask open-ended questions designed to gather as much information as possible. The investigator should use memory aids such as a calendar to prompt the case-patient's memory on every food eaten and place visited during the time period in question. Following the interview, the interviewer should direct the case-patients to contact him/her if they later recall any additional exposures. Since this type of interview relies on the interviewees' ability to recall information accurately, it becomes important that the investigation be initiated and the interviews be conducted as soon as possible after the outbreak is recognized. If the investigators are still unable to develop a hypothesis about the outbreak source, as stated above, implementing a case control study at this point is expected to be of little value.

Our recent investigation, the CDC memo and insights from Paul Blake illustrate the importance of developing a hypothesis before beginning a case control study or analyzing the data. This is especially difficult in outbreak settings that have few cases with no known epidemiological link where timely interviewing of cases is essential. Much of the responsibility for the success or failure of such investigations hinges on the interviewing skills of the investigator. Therefore, public health agencies committed to expanding their outbreak response capacity should devote time and effort to enhancing the interviewing skills of their staff.

And as for those "cooked crabs" that caused a cholera outbreak in 1978, the researchers believe the implicated crabs were not cooked long enough to destroy all cholera organisms and were subsequently left unrefrigerated for several hours, allowing these bacteria to proliferate [1]. Crab shells change color when boiled and persons may assume they are safe to eat after the color changes. The color change process normally takes only five minutes, which is not a sufficient cooking time for crabs [2]. The outbreak investigators demonstrated that crabs must be boiled for at least eight minutes to kill all the cholera organisms [1].

[1] Blake PA, Allegra DT, Snyder JD, et al. Cholera--a possible endemic focus in the United States. NEJM 1980:302:305-9. Abstract available online: http://content.nejm.org/cgi/content/abstract/302/6/305

[2] Hanks, III, D. The hard facts about hard-shells. The Washington Post. August 11, 1999. Available online: http://www.washingtonpost.com/wp/srv/style/restaurants/features/crabs990911.htm

An Evaluation of the Patient Code Number for HIV Case Reporting in Illinois

By Stephanie Borchardt Ph.D., M.P.H.

Advances in AIDS-related therapies delayed the onset of AIDS-defining illnesses, but reduced the usefulness of AIDS surveillance in assessing the incidence of early HIV disease and estimating future needs of the HIV-infected population.[1] These changes prompted renewed interest in expanding surveillance to include HIV and engendered national debate on whether an HIV surveillance system should be based on reports of the names of infected individuals or employ non-name-based data codes.[2]

In the fall of 1998, the Illinois Department of Public Health (IDPH) amended the Control of Sexually Transmissible Disease Code (77 IL Adm Code 693) to require reporting of cases of AIDS and HIV infection. This section was amended following publication of the proposed amendments in The Illinois Register, February 27, 1998. The amended section required reporting cases of HIV infection by a Patient Code Number (PCN) effective July 1, 1999 for a two-year period. Cases of AIDS remained reportable by patient name as they have been since 1985.

In compliance with the requirements of the Control of Sexually Transmitted Diseases Code (77 IL Adm Code 693) an evaluation of the PCN was performed based upon the following criteria:

> "The Department will monitor HIV reports to determine the effectiveness of the HIV surveillance system. Beginning on July 1, 1999, the Department will collect data to be continually evaluated to determine whether the following criteria are satisfied:
>
> 1. All elements of the patient identification code are complete in at least 90 percent of all reported cases;
> 2. Patient risk is provided in 90 percent of case reports and the remaining information in the case report is complete in 85 percent of the case reports after epidemiologic follow-up is completed;
> 3. No more than 5 percent of cases in the HIV database are duplicate reports;
> 4. 95 percent of providers will be able to link a patient code number to a case report when additional follow-up is necessary; and
> 5. A system to link at least 95 percent of the patient code numbers for reported cases of HIV infection to the subject of the case report, maintained by at least 95 percent of the providers."

The first evaluation of the PCN was conducted during 2001. Data collected during the first year of using the PCN indicated that two of the five evaluation criteria were met. Data were insufficient to determine the ability of the provider to link PCN to subject case reports (Criteria 5). Illinois continued to use the PCN to report cases of HIV, however, the PCN was to be re-evaluated at a later date. We describe the findings of the second evaluation of the PCN performed during 2005 that specifically examined Criteria 4 and 5 of the Control of Sexually Transmitted Diseases Code (77 IL Adm Code 693).

Facilities that reported one or more cases of HIV during Jan. 1, 1999 to Dec. 31, 2004 in Illinois were queried from the HIV/AIDS Reporting System (HARS). The list included facilities that reported cases of HIV and cases of HIV that progressed to AIDS, but excluded cases reported only as AIDS and never as HIV during the time frame. The sampling frame contained 594 facilities that reported one or more cases of HIV during 1999 to 2004. Forty-three facilities were randomly selected from the sampling frame. The Core Center was selected to be included in the evaluation, given that the largest number of case reports originated from this facility. Therefore 44 facilities contributed data to the evaluation. Twenty-nine percent (4,161/14,274) of all HIV case reports during 1999 to 2004 originated from these 44 facilities.

If a facility reported ≤ 50 cases of HIV during 1999 to 2004, then all of the corresponding PCNs were reviewed. For facilities that reported > 50 cases during the time frame, we selected a random sample of 50 PCNs to review. Nine of the 44 facilities reported > 50 cases during 1999 to 2004.

A letter was sent to each facility describing the evaluation and reason for the site visit. Each facility was later contacted to schedule a site visit. Facilities were not provided a list of the PCNs prior to the visit. The 44 site visits were performed during August to September 2005. At each visit we asked to see the facilities' provider log and presented the facility with a list of ≤ 50 PCNs for which the corresponding medical record was to be produced. An evaluation form was completed for each facility (Appendix A). The form was used to record whether each facility had a system to link the PCN to a case report and to record the number of medical records that were retrieved by each facility. The number of PCNs produced using the medical record that matched the PCN from HARS was also recorded.

Only 36 percent (16/44) of facilities maintained a provider log that specifically included the PCN for each case, although 77 percent (34/44) of facilities had a system to link the PCNs for reported cases of HIV infection to the subject of the case report, regardless of whether they maintained a provider

log. Examples of systems to link the PCN to a case report included: searching the facility database by date of birth to narrow the possible matches followed by matching on the first and third letters of the last name, number of characters in the last name and gender; searching by the medical record number retrieved from a copy of the case report form maintained at the facility; searching by first letter of the last name and confirming a match using the other components of the PCN; and linking a PCN to a case report by recalling the patient name given that few case reports originated from the facility.

Of the medical records we attempted to review, 60 percent (409/681) were produced for review during our visit (Table 1). However, factors beyond the control of the facility affected this number. For example, many facilities store inactive or dated medical records off-site. In at least one instance a medical record could be retrieved from an off-site storage facility during our visit, but in most instances a day or more was needed to retrieve the record. Of the medical records that were produced during our visit, 92 percent (375/409) of PCNs created from the medical record matched the PCN listed in HARS.

This evaluation of the PCN in Illinois demonstrates that the current system failed to meet Criteria 4 and 5 of the Control of Sexually Transmitted Diseases Code (77 IL Adm Code 693). Criterion 4 states that "95 percent of providers will be able to link a patient code number to a case report when additional follow-up is necessary." However, 92 percent of PCNs created using the medical records produced matched the PCN listed in HARS. Criterion 5 states "A system to link at least 95 percent of the patient code numbers for reported cases of HIV infection to the subject of the case report, maintained by at least 95 percent of the providers." We found that 77 percent of facilities had a system to link the PCNs for reported cases of HIV infection to the subject of the case report, and fewer still (36%) maintained a provider log. The U.S. Centers for Disease Control and Prevention does not include non-name-based data in national HIV/AIDS reports. Furthermore, the Ryan White Care Act, which funds treatment and care for HIV-infected persons, may soon use a formula based on CDC HIV case counts for distribution of funds to states that will likely underestimate the burden of disease in Illinois under a non-name-based system. As of Jan. 1, 2006 Illinois has transitioned to a confidential name-based HIV reporting system.

References

[1] Solomon L, Flynn C, Eldred L, et al. Evaluation of a statewide non-name-based HIV surveillance system. *J Acquir Immune Defic Syndr*. 1999;22:272-279.

[2] Osmond DH, Bindman AB, Vranizan K, et al. Name-based surveillance and public health interventions for persons with HIV infection. *Ann Intern Med*. 1999:131:775-779

Table 1. Number of matches between patient code number (PCN) and case medical record by year of case report

Time period	Medical records produced No. (%)	PCN match for all medical records* No. (%)	PCN match for all medical records † No. (%)	PCN match only for medical records produced No. (%)
1999 to 2001	151/263 (57)	133/263 (51)	245/263 (93)	133/151 (88)
2002 to 2004	258/418 (62)	242/418 (58)	402/418 (96)	242/258 (94)
Overall, 1999 to 2004	409/681 (60)	375/681 (55)	647/681 (95)	375/409 (92)

* All medical records that were not produced were included and counted as non-matching, thus providing the maximum estimate of non-matching records.
† All medical records that were not produced were included and counted as matching thus providing the maximum estimate of matching records.

County Corner

Local Health Department Reports of Outbreaks, Studies or Prevention Efforts

Enterotoxigenic *E.*coli: The enteric pathogen that travels

By Tom Stolt, M.P.A., L.E.H.P., Foodborne Illness and Quality Assurance Coordinator, DuPage County Health Department

On the afternoon of Thursday, June 2, 2005, the Environmental Health staff of the DuPage County Health Department (DPCHD) received two unrelated calls regarding possible foodborne

illnesses associated with eating at a Mexican restaurant in Lombard, Illinois on the evening of Friday, May 27, 2005.

On June 2, 2005, an inspection of the facility was conducted to review the preparation practices of the food items served to the ill cases, such as fajitas, guacamole, chips and salsa. The inspection did not reveal any serious procedural issues nor were there other factors present that might have contributed to the outbreak. None of the actual food prepared and served on May 27 was available for testing.

On Friday, June 3, four additional unrelated groups had called DPCHD. From these six groups, 21 case histories were completed (18 ill and three well). The ill cases displayed a profile involving a very high prevalence of diarrhea and abdominal cramping lasting four or more days and a low prevalence of vomiting and fever. In consultation with the IDPH Division of Infectious Diseases, it was determined that case sampling would involve testing for Enterotoxigenic *E. coli* (ETEC) and the enteric pathogens *Salmonella, Shigella* and other *E. coli*.

On June 3, the facility was again visited after they voluntarily agreed to close. Nine employee health histories and stool samples were taken from the limited number of staff present, who were mostly managers. Chips and salsa and fajitas were the two most prominent meal items among ill cases. Laboratory tests for *Salmonella*, standard plate count, coliform and *E. coli* were performed on the salsa, pico de gallo, and guacamole (all freshly made the day they were collected). The food items came back negative for *E. coli* and *Salmonella* and were inconclusive for the other tests.

Sixty-five employee health history questionnaires were completed on June 6. Three employees (a hostess, a server and a bartender/server) stated they had eaten food at the restaurant on May 27 and became ill after working the evening's shift. None of the employees reported having traveled outside the continental United States in the weeks before the outbreak.

A blast fax was sent out to DuPage County physicians alerting them of the investigation of diarrheal illness. The fax requested that patients with diarrheal illness be screened for recent history of dining at a Mexican restaurant in Lombard and to report any illness meeting the case definition to the DPCHD. A case was defined as an individual who experienced diarrhea, abdominal cramping and/or vomiting six or more hours after eating a meal at the restaurant on Friday, May 27, 2005.

The facility re-opened Tuesday evening (June 7) for dinner. Only those employees who provided health histories and had received in-service training from DPCHD staff on hand washing and handling of ready-to-eat foods were allowed to return to work. Employees who became ill after May 27th were permitted to return once their symptoms subsided.

Case symptoms included diarrhea, abdominal cramping, nausea, fever, headache, chills, dehydration and vomiting (Table 1). The diarrhea-to-vomiting prevalence ratio was 7:1. The median incubation period was 31.1 hours [range 6 to 84 hours], the median duration of illness was 4.5 days [range 1 to 13 days]. The average age of those reporting illness was 37 years with a range of 22 to 55 years.

Table 1. Signs and symptoms of illness among 21 cases of food poisoning due to Enterotoxigenic *E.coli*.

Symptom	Prevalence
Diarrhea	100%
Abdominal cramping	86%
Nausea	52%
Fever	48%
Headache	48%
Chills	48%
Dehydration	48%
Vomiting	14%

Four individuals reporting symptoms of illness sought medical treatment by their physicians. None of the cases required hospitalization. Twenty stool samples were collected, five from cases (four patrons and one employee) and 15 from key food service employees who did not have symptoms of illness. All 20 samples submitted were negative for routine enteric pathogens. Eleven samples (four of the five cases and seven of the 15 well employees) were tested by the IDPH laboratory for ETEC using the Multiplex polymerase chain reaction (PCR) analysis method. Four of the case samples tested positive for ETEC- ST (heat stable) serotype

O169:H41. The CDC confirmed the positive ETEC-ST results of the four samples.

None of the food implicated could be reliably analyzed for a statistical relationship using food-specific attack rate data because of insufficient recruitment of well persons (controls). The restaurant received fresh produce six of the seven days per week they were open.

ETEC is commonly referred to as the cause of "travelers' diarrhea" among travelers in developing countries. Outbreaks occurring in the United States often are the result of the ingestion of bacteria-contaminated food. Cases in this outbreak displayed a high diarrhea-to-vomiting ratio (7:1), while testing negative for other enteric pathogens. The profile of this outbreak closely matched profiles of previously reported outbreaks, with clinical criteria of "an incubation period of 24 to 48 hours, a duration of illness ≥60 hours, and a diarrhea-to-vomiting prevalence ratio of ≥ 2.5."[1]

It is possible that a common ingredient shared by both the salsa and the fajitas and their side dishes were contaminated before arriving at the restaurant. However, without a case-control study, one cannot make any conclusions about the source of this restaurant outbreak. Many ready-to-eat produce containing items are used across several menu items. Some of these items may have contained bacteria that would not have been destroyed because the products were not cooked. While the facility was closed, emphasis was placed on educating all food service staff of the importance of washing all produce before preparation, on raising their awareness of cross contamination issues and the need for diligent hand washing before they could re-open. Foods that once were available only seasonally are now available year-round due to importation, often from developing countries. As a result, ETEC, an important cause of traveler's diarrhea, can travel to a restaurant near you.

[1] Beatty M, Bopp C, Wells J, Greene K, Puhr N, Mintz E. Enterotoxin-producing *Escherichia coli* O169:H41, United States. Emerg Infect Dis 2004 Mar;10(3):518-21.

The Public Health Worker: Julio Fernandez

By Michele McGee, M.P.A.

Note: This is a new feature that highlights public health workers and provides an opportunity to learn from their diverse experiences.

In 1991 in Peru, South America, over 300,000 people were ill with diarrheal disease. Patients arrived at hospitals so frequently, there was absolutely no time for standard screening questions or blood work. During this time, one of the people treating patients and helping to prevent further illness was Dr. Julio Fernandez, the current Communicable Disease Program Supervisor at the Chicago Department of Public Health (CDPH). Prior to coming to the United States, Julio was actively working in his native country of Peru by helping treat patients and saving lives during the 1991 South American outbreak of cholera. The patients required, "four I.V. s…we knew it was cholera and [that] lots of fluids and antibiotics were needed." The hospital was so busy, "Even the paramedics were helping provide treatment." Afterwards, Julio noted, "a message of prevention was key." People needed to be educated on the use of safe food, water and hygiene. Surveillance and education were both important in ending this massive outbreak. Thus, this cholera outbreak is one of the noteworthy public health experiences with which Julio has been involved.

In 1972 and 1973, Julio helped organize and execute a community based national campaign for immunization as a medical student. In Lima, Peru in 1977 at the Dos de Mayo Hospital, Julio worked as a physician, MC (equivalent to MD) and was nominated to be President of the Medical Residents Association. From 1977 until 1995, Julio held various positions in health facilities throughout Lima. His focus was on screening and education of diabetes, hypertension and tuberculosis. In 1995, Julio came to the United States and shortly after, in 1996, he began working at the CDPH.

Currently, in his role as Communicable Disease Supervisor, Julio primarily focuses on assessing each case, whether received by telephone call, mail or fax, to determine if there is a public health threat. He is also responsible for identifying the source of infection, common exposures and risk factors. In essence, he serves as a front line defense against communicable diseases for all of Chicago.

Additionally, the Communicable Disease Program staff at CDPH includes Communicable Disease I Investigators, Epidemiologists, Data Entry Operators, and Administrative Assistants.

Julio believes his work has successfully impacted the public in various ways. For example, during October 2003, a cluster of six cases of invasive *Neisseria meningitidis* infection was detected among adult males in Chicago, three of whom died; he was thoroughly involved in investigating these cases. Since this cluster occurred among members of the men who have sex with men (MSM) community, a tremendous strategy was initiated by CDPH to urge the public at risk to get immunized with the meningococcal vaccine. Julio stated, "rapid response," was pivotal in ensuring a successful epidemiologic investigation and large immunization response.

Julio believes that three areas neglected in public health are participation of the community, education, and surveillance. In particular, "Participation of the community to make decisions regarding public health is lacking." While working at a community health center in Peru, Julio has been part of a committee that created ways to encourage the public to embrace better nutrition habits. This committee was very concerned about enteric infectious diseases. The committee held meetings to solicit the community's input. They also secured about 50 temporary workers, who provided assistance towards this effort. Specifically, the workers needed to be available to assist in shifts, at the health facility 24 hours a day, for two weeks. Additionally, Julio advocates educating the public about their health as early as elementary school. He suggests that the material taught should be a part of the overall curriculum as is reading, math and spelling.

Julio also feels surveillance is an area that needs to be reinforced. Julio offers, "Surveillance is the key [to] the prevention of spread of disease. Without surveillance there would be no disease control. Without the astute clinician or laboratory looking for unusual illnesses or clusters of illness, outbreaks of disease would not be stopped and may even go undetected thus placing the population as a whole at risk for many infectious diseases." Similarly, Julio feels it is important that local health departments share experiences and information. He suggested having statewide meetings where local health departments in Illinois could exchange information, which would be beneficial in public health, especially during outbreaks investigations.

When asked about the quality of public health work, Julio feels public health workers can be more effective if they are part of a continuous education system in infectious diseases, combined with certain important criteria related to public health workers like responsibility, commitment and service. He proposes that continued training on infectious/communicable diseases be mandatory.

In recent years, with the shift to bioterrorism preparedness and response, Julio recommends that public health workers "keep the faith; you can make a difference." He stated that losing this attitude, would produce a feeling of being "just another worker." Hence, with so much work to be done in communicable disease, Julio states that if he had to pick three infectious diseases most in need of eradication, he would first choose, tuberculosis, which "we know very much about clinical presentation, excellent treatment is available and prevention strategies are well known, but it is still a problem." He would also choose viral hepatitis, because of the, "high incidence of hepatitis A, B and C and the multiple methods of prevention that are available for each of these viral infections." Finally, his third choice would be enteric infections because, "we still have high numbers of parasitic, bacterial and viral gastrointestinal infections per year and most of them could have been prevented by good hygiene and safe food practices."

Julio Fernandez has been working in public health for almost 30 years. He is an advocate of community involvement. He believes one is never too young or old to learn sound public health practices. He also feels surveillance is essential to ultimately eradicate infectious diseases. In short, Julio is dedicated to protecting the public's health.

Surveillance Is Information for Action: Brucellosis

By Kathy Ritger, M.D., M.P.H.

Q: What is the epidemiology of brucellosis and what public health action is triggered when a case of brucellosis is reported to a local health department?

A: Brucellosis is a bacterial zoonosis found in both domestic and wild animals and in humans. Currently six species are included in the genus *Brucella*, but humans are susceptible to just four (in order of most pathogenic to least): *B. melitensis* (found mainly in sheep and goats), *B. suis* (swine), *B. abortus* (cattle), and *B. canis* (dogs). Of these organisms only *B. canis* is present in animals in Illinois, but transmission from dogs to humans is rare.

Infection with any of these organisms produces brucellosis—a systemic infection in which any organ or system of the body can be involved. However, most patients experience fever (in an "undulant" or up-and-down temperature pattern), fatigue, and weight loss. Depression, back pain, and malodorous perspiration are other characteristic symptoms, although they are not seen as commonly. Chronic brucellosis is usually caused by persistent localized infection of bones, joints, liver, spleen, or kidneys. The mortality rate for untreated cases is approximately 2 percent.

Transmission to humans occurs most commonly by ingestion of unpasteurized dairy products made from the milk of infected animals. Veterinarians, farmers, butchers, and slaughterhouse workers also can be infected by direct contact with infectious animals or their secretions in areas where *Brucella* is endemic in domestic animals. Inhalation of infectious aerosols is an uncommon, but significant route of transmission for persons who work in laboratories where the organism is cultured. Although very rare occurrences of human-to-human transmission have been reported via sexual contact, breast milk, and intrauterine exposure, as a rule there is little concern for secondary spread. The incubation period varies considerably, from less than one week to six months, but most patients become ill within three to four weeks of exposure.

Brucellosis is found worldwide. Certain areas of the world have a high prevalence of infection, including the Mediterranean basin, the Arabian peninsula, the Indian subcontinent, and parts of Mexico and Central and South America. In the United States, about 100–200 cases of brucellosis are reported annually, with most cases resulting from consumption of unpasteurized dairy products during travel to endemic areas. In Illinois, ≤10 cases have been reported annually for the past 10 years. The source of infection for recent Illinois cases mirrors the national data (Table 1).

Eradication of human brucellosis depends largely on elimination of the disease in animals, and programs that actively work for the eradication of animal brucellosis and pasteurization of dairy products have been effective in reducing the burden of disease in humans and cattle. In the United States, the Brucellosis Eradication Program, under the auspices of the Animal and Plant Health Inspection Service (APHIS) of the USDA, was begun in 1934 to eliminate brucellosis from cattle. States are designated brucellosis free when none of their cattle or bison is found to be infected for 12 consecutive months under an active surveillance program. A similar program of active surveillance and eradication of swine brucellosis also exists. Illustrating the success of these programs, in 1956 there were 124,000 affected herds in the United States, and in 2004 there were only five known affected herds. The decrease in human cases in the United States is similarly striking: in 1947, 6,321 human cases were reported; in 2003, 104 human cases were reported. Illinois has held bovine brucellosis free status since 1992 and swine brucellosis free status since 1984.

Cases of brucellosis in Illinois should be reported to the local health authority within seven days of isolation of the organism or notification of a positive serological test. However, because *Brucella* is a Category B bioterrorism agent, any case thought to be related to a bioterrorism event should be reported immediately to Illinois Department of Public Health (IDPH). Laboratory reporting is required, and isolates must be forwarded to IDPH for further testing.

When the local health authority receives a report of a suspected case of brucellosis, the investigator first makes certain that the patient meets the case definition, which includes both clinical and laboratory components (Table 2). Laboratory tests providing confirmation of brucellosis include agglutination titers and culture, both of which are performed at the U.S. Centers for Disease Control and Prevention (CDC.) Currently, Quest, LabCorp, and Mayo laboratories do not offer these tests. The qualitative antibody tests (such as ELISAs) done at commercial laboratories do not fulfill the case definition; therefore, clinicians should take care to order an agglutination titer and culture instead to

confirm the diagnosis. False positives are possible with the ELISA tests currently available.

After case confirmation, the investigator interviews the case to determine how and where the infection was potentially acquired. Lines of questioning include occupation, animal contact within six months prior to onset, exposure to *Brucella* vaccine used in cattle (usually by accidental needle stick), consumption of unpasteurized dairy products made in endemic areas, and travel history to endemic areas. While United States federal regulations require pasteurization of all milk and milk products delivered into interstate commerce (with a few exceptions for approved alternative processes), it is believed that unpasteurized dairy products are frequently smuggled into the United States for personal or family consumption. Therefore, it is important to specifically ask about this practice when interviewing a case.

If the investigation were to reveal that a dairy product made or sold in Illinois was a possible source of infection, the IDPH Division of Food, Drugs, and Dairies would collect any remaining product for microbiologic testing, embargo further sale of the product, conduct a trace back, and, if necessary, investigate the cause of improperly pasteurized product. If the investigation showed that animals in Illinois were a possible source of infection, the Illinois Department of Agriculture would test the suspected herd. Infected herds would be quarantined and infected animals sent for slaughter.

Cases that are confirmed by culture require special attention on the part of investigators. *Brucella* organisms on a culture plate can become aerosolized. Infection of laboratory workers has resulted following laboratory accidents (such as broken centrifuge tubes), sniffing of culture plates, and even routine laboratory work done outside of biological safety cabinets. An estimated 2 percent of all brucellosis cases in the United States are laboratory-acquired. Since brucellosis is uncommon in the United States, most laboratorians do not suspect *Brucella* species when presented with an unknown culture. Clinicians suspecting brucellosis should alert laboratory personnel to this possibility when submitting specimens.

Because laboratory workers risk acquiring *Brucella* organisms via non-intact skin, mucus membranes, and aerosols, biosafety level (BSL) 3 practices, equipment, and facilities are recommended for all manipulations of *cultures* of pathogenic *Brucella* species (Table 3). BSL 2 practices are recommended for activities with clinical *specimens containing or potentially containing* pathogenic *Brucella* species, as the risk of transmission posed by these specimens is much lower. In the event of a spill of a suspension of living *Brucellae*, the laboratory should be immediately evacuated while the spill is cleaned by trained personnel wearing a safety mask, goggles, gown, and gloves.

In 2005, three laboratories in Illinois reported inadvertent exposure to *Brucella* cultures. Each occurrence required investigation of the extent of exposure and follow-up of exposed workers. In the event of a laboratory accident or that insufficient BSL precautions were taken to prevent the aerosolization of the organism, the investigator should obtain the names of all personnel present in the laboratory during the work-up and identification of the *Brucella* isolate. Draft guidelines from CDC recommend that each worker have an assessment of risk; and workers determined to have had high-risk exposure should be recommended for antibiotic prophylaxis. The draft guidelines also recommend all exposed workers have serial agglutination titers to check for seroconversion. Additionally, all exposed workers should be monitored for symptoms consistent with brucellosis for at least six months. The Communicable Disease Control Section of IDPH can assist local health departments and laboratories with procedures to follow in the event of a laboratory exposure.

Sources

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2. Pappas G, Akritidis N, Bosilkovski M, Tsianos E. Brucellosis. *N Engl J Med*. 2005; 352:2325–36.
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4. Robichaud S, Libman M, Behr M, Rubin E. Prevention of Laboratory-Acquired Brucellosis. *Clin Infect Dis* 2004;38:e119–22.

5. Animal and Plant Health Inspection Service (APHIS) website: http://www.aphis.usda.gov/vs/nahps/brucellosis/
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Table 1. Annual number of reported cases of brucellosis and suspected source of infection - Illinois, 2001–2004

Year	No. Cases	Source		
		Travel to endemic area*	Ate unpas-teurized dairy†	Unknown ‡
2004	9	3	4	4
2003	0	--	--	--
2002	7	5	5	0
2001	4	2	2	2

*Destinations included Mexico, India, Pakistan, and Greece.
†Includes both dairy products imported to the United States and products consumed abroad.
‡Includes persons lost to follow-up and those without identified source of infection.

Table 2. Brucellosis case definition
(from MMWR Vol. 46 (RR-10);1-55)

Clinical description
An illness characterized by acute or insidious onset of fever, night sweats, undue fatigue, anorexia, weight loss, headache, and arthralgia

Laboratory criteria for diagnosis
- Isolation of *Brucella* sp. from a clinical specimen, or
- Fourfold or greater rise in Brucella agglutination titer between acute- and convalescent-phase serum specimens obtained ≥2 weeks apart and studied at the same laboratory, or
- Demonstration by immunofluorescence of *Brucella* sp. In a clinical specimen

Case classification
Probable: a clinically compatible case that is epidemiologically linked to a confirmed case or that has supportive serology (i.e., *Brucella* agglutination titer of greater than or equal to 160 in one or more serum specimens obtained after onset of symptoms)
Confirmed: a clinically compatible case that is laboratory confirmed

Table 3. Summary of recommended biosafety levels for infectious agents (adapted from Biosafety in Microbiological and Biomedical Laboratories. 4th ed. Washington DC: US Department of Health and Human Services; 1999:52-3.)

Biosafety Level	Practices	Equipment	Facilities
1	Standard micro-biological	None required	Bench top sink
2	BSL 1 plus: Limited access Warning signs Sharps precautions Biosafety manual	Class I or II biological safety cabinet (BSC) for manipulations causing splashes or aerosols Laboratory coats, gloves Face protection as needed	BSL 1 plus: Autoclave available
3	BSL 2 plus: Controlled access Decontamina-tion of waste Decontamina-tion of lab clothing before laundering	Class I or II BSC for all open manipulations of agents Respiratory protection as needed	BSL 2 plus: Separation from access corridors Self-closing, double-door access Exhausted air not re-circulated Negative airflow into laboratory
4	BSL 3 plus: Clothing changes before entering Shower on exit All material decontamina-ted on exit from facility	All procedures conducted in Class III BSC, or Class I or II BSC in combination with full-body positive pressure suit	BSL 3 plus: Separate building or isolated zone Dedicated supply and exhaust, vacuum, and decontamina-tion system Various other requirements

Kudos

Macon County Health Department has reported 61 confirmed and 27 probable cases of pertussis for the year 2005 (numbers are provisional). Cases began occurring in January and continued throughout the year. The age of the cases ranged from infants through elderly, but the largest number of cases were in the 10-19 year old age group. Cases were not clustered in just one area, such as schools, businesses or church groups, so surveillance had to be enhanced in the entire community.

Control measures included enhanced school monitoring, news releases, and frequent communication alerts with local physicians and hospitals.

The comprehensive investigation of cases and contacts helped prevent the spread of secondary cases. In order to contain the outbreak, the health department redirected personnel from other areas of the health department and trained them to assist with ongoing surveillance. An additional measure was the use of PCR lab testing that improved the turn-around time of results and assured that prophylaxis treatment of contacts began quickly. The health department also instituted a more aggressive approach by offering an immunization clinic for persons 11-18 years of age using the recently licensed Tdap vaccines.

In addition to Macon County, other areas of the state experienced pertussis outbreaks and each of the respective health departments should be commended for aggressively implementing surveillance and outbreak control measures in their communities.

Upcoming Events

June 12-14, 2006 - Immunization and Communicable Disease Conference and Downstate Emergency Preparedness and Response Conference.
Crowne Plaza, Springfield, IL

August 7-9, 2006 – Illinois Bioterrorism Summit: Partners Sustaining the Heartland.
Oak Brook Hills Marriott Resort, Oakbrook, IL

Factoid The "German" in German measles is probably not of geographical derivation. Likely, it represents that German authors wrote a lot about the disease before the term "rubella" was adopted in 1881. It is possible that the term "German" actually comes from the Old French *germain* which comes from the Latin *germanus* which means 'very like.' Applying that meaning, it would turn German measles (or rubella) into 'very like' ordinary measles. Rubella is like measles, but there are differentiating features that physicians familiar with the two have cited. One example is that the macular spots of rubella are flat and circular, while those of measles are raised and irregular.

Article Alert

In an effort to keep you updated on recent published infectious disease articles with local or state public health department authors, please be aware of the following:

- Causer LM, Handzel T, Welch P, Carr M, Culp D, Lucht R, Mudahar K, Robinson D, Neavear E, Fenton S, Rose C, , Craig L, Arrowood M, Wahlquist S, Xiao L, Lee Y-M, Mirel L, Levy D, Beach MJ, Poquette G, Dworkin MS. An outbreak of *Cryptosporidium hominis* infection at an Illinois recreational waterpark. Epidemiology and Infection 2006 134;147-156.

- Yoder JS, Cesario S, Plotkin V, Ma X, Kelly-Shannon K, Dworkin MS. Outbreak of enterotoxigenic *Escherichia coli* infection with an unusually long duration of illness. Clinical Infectious Disease 2006;42:1513-7.

- Gerber SI, Jones RC, Scott MV, Price JS, Dworkin MS, Filippell MB, Rearick T, Pur SL, McAuley JB, Lavin MA, Welbel SF, Garcia-Houchins S, Bova JL, Weber SG, Arnow PM, Englund JA, Gavin PJ, Fisher AG, Thomson RB, Vescio T, Chou T, Johnson DC, Fry MB, Molloy AH, Bardowski L, Noskin GA. Management of outbreaks of methicillin-resistant *Staphylococcus aureus* infection in the neonatal intensive care unit: a consensus statement. Infection Control Hospital Epidemiology. 2006;27:139-45.

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