The Impact of Health Communication and Enhanced Laboratory-Based Surveillance on Detection of Cyclosporiasis Outbreaks in California

Janet C. Mohle-Boetani,* S. Benson Werner,*
Stephen H. Waterman,* and Duc J. Vugia*†
*California Department of Health Services, Berkeley, California, USA; and
†The California Emerging Infections Program, Berkeley, California, USA

We investigated the timing of diagnosis, influence of media information on testing for *Cyclospora*, and the method used to identify cases during eight cyclosporiasis outbreaks in California in spring of 1997. We found that Internet information, media reports, and enhanced laboratory surveillance improved detection of these outbreaks.

Cyclospora cayetanensis, a recently identified coccidian parasite of humans (1), causes explosive watery diarrhea that can persist for several weeks (2). The oocysts cannot be detected by standard ova and parasite testing; methods specific for *Cyclospora* include modified acid-fast or other stains, autofluorescence with ultraviolet epifluorescence microscopy, and wet mount under phase-contrast microscopy (3). The infection can be treated with trimethoprim-sulfamethoxazole (TMP-SMX) (4). Eight outbreaks in California were among the 41 event-associated clusters of cyclosporiasis associated with Guatemalan raspberries identified in the United States and Canada in 1997 (5).

We examined factors contributing to the identification of outbreaks of this emerging infectious disease. The detection of outbreaks was enhanced by Internet information that patients brought to their physicians, media reports, and enhanced laboratory-based (ELB) surveillance. ELB surveillance, part of the California Emerging Infections Program (EIP), is a cooperative agreement between the California State Health Department, the University of California Berkeley School of Public Health, selected local counties, and the Centers for Disease Control and Prevention.

Address for correspondence: Janet Mohle-Boetani, Disease Investigations Section, Disease Investigation and Surveillance Branch, Division of Communicable Disease Control, California Department of Health Services, 2151 Berkeley Way, Room 708, Berkeley, CA 94704, USA; fax: 510-540-2570; e-mail: jmohlebo@dhs.ca.gov.

The Study

An outbreak of cyclosporiasis was defined as diarrhea (three or more loose stools per day for at least 3 days) in two or more persons who shared a meal and became ill within 2 weeks, and laboratory confirmation of *Cyclospora* infection in at least one person. The first person with laboratory-confirmed *Cyclospora* infection identified in an outbreak was designated the index patient.

We interviewed each index patient about the onset of symptoms and medical care, and we reviewed laboratory records to determine the date of testing for *Cyclospora*. Through information that we gathered from patients and their physicians, we determined the reason for testing for *Cyclospora* (e.g., symptoms alone, symptoms and media attention, or symptoms and Internet information). We interviewed all guests at a wedding reception (event 3, Table) to determine the proportion of ill persons who sought medical attention, submitted stool specimens tested specifically for *Cyclospora,* and received recommended treatment for *Cyclospora* infections, all with respect to timing of media coverage of *Cyclospora* outbreaks.

To assess the impact of ELB surveillance on outbreak detection, we determined the proportion of outbreaks identified by ELB surveillance. All 22 laboratories in eight participating counties

Table. Event-associated outbreaks of cyclosporiasis, California, 1997

Outbreak number, type month/day of event	Event to symptoms	Symptoms to medical care	Seeking of medical care[a]	Timing of stool collection	Stool testing[a]	Stool collection to *Cyclospora* verification	Method of outbreak detection[b]
1, Banquet, 4/1	7 days	None–patient was physician	No	39 days after onset	No[c]	2 days	Report of illness cluster by patient[d]
2, Conference, 4/17	7 days	None–patient was physician	No	19 days after onset	No[e]	6 days	Report of illness cluster by physician[d]
3, Wedding, 5/3	7 days	18 days	Yes (I) bride sent information	1 day after visiting physician	Yes (I) patient requested	1 day	Interview of index patient identified through ELB[f] surveillance, 4 days
4, Barbecue, 5/10	8 days	1 day and repeat phone calls for 2 weeks	No	15 days after visiting physician	Yes (M) patient requested	1 day	Interview of index patient identified through ELB[f] surveillance, 6 days
5, Picnic, 5/11	7 days	18 days	Yes (M and I) Internet searches after media reports	1 day after visiting physician	Yes (I) patient requested	4 days	Interview of index patient identified through ELB[f] surveillance, 41 days
6, Card Party, 5/14	7 days	14 days	No	24 days after visiting physician	Yes (M) patient notified health dept., which recommended testing	3 days	Report of illness cluster by patient[d]
7, Dinner, 5/21	5 days	3 days	No	1 day after visiting physician	Yes (M) physician saw TV show on outbreaks	3 days	Interview of index patient identified through ELB[f] surveillance, 3 days
8, Luncheon, 5/24	6 days	1 day	Yes (M, and I) Internet searches after media reports	2 days after visiting physician	Yes (I) patient requested	1 day	Interview of index patient identified through ELB[f] surveillance, 3 days
Median (range)	7 days (5-8 days)	8.5 days (1-18 days)	2 days (1-24 days)		2.5 days (1-6 days)		4 days (3-41 days) For ELB surveillance notifications for all outbreaks

[a]Prompted by Internet (I) or Media (M) information.
[b]By local health department, time from laboratory verification to notification of the health department (if applicable).
[c]Testing was requested by the patient based on her knowledge of tropical medicine.
[d]The health department was aware of pending test results and the index patient was known to the health department prior to laboratory verification.
[e]Specific testing was not requested by a physician but was conducted by a laboratorian who had just read a journal article about *Cyclospora*.
[f]ELB denotes enhanced laboratory-based surveillance.

in northern California submitted biweekly or monthly laboratory reports on *Cyclospora* to EIP. EIP staff then forwarded case information to the local health departments for follow-up.

The eight index patients were tested for *Cyclospora* infections a median of 18.5 days after symptom onset (range 3-39 days, Table); 6 (75%) were diagnosed >14 days after onset (events 1-6, Table). The two index cases diagnosed within 1 week of disease onset occurred after media announcements about clusters of cyclosporiasis in the United States were widespread in late May 1997 (events 7 and 8, Table). Testing for 6 (75%) index patients was apparently prompted by this media coverage (events 3-8, Table). After reading newspaper articles, three index patients (events 3, 5, and 8) obtained information on the diagnosis and treatment of *Cyclospora* from Internet searches, brought this information to their physicians, and requested testing. One index patient (event 4) read about other clusters in the United States in the newspaper and requested testing from her physician. Another index patient (event 6) suspected that she and a group of friends had *Cyclospora* infections after reading a list of symptoms in a newspaper article and reported this cluster to the local health department, which then recommended testing for *Cyclospora.* One index patient (event 7) was tested by a clinician who watched a television report about cyclosporiasis the morning of the patient's visit to the clinic.

Within 2 weeks after a wedding party in May (event 3, Table), 30 (65%) of 46 guests had diarrhea; within 3 weeks, 13 sought medical attention. Although seven patients submitted stool specimens, none was tested for *Cyclospora*. Approximately 3 weeks after the wedding, several ill guests and the bride (who had not eaten the mixed berry dessert and was not ill) read media accounts of a *Cyclospora* outbreak that had occurred in Reno, Nevada. They recognized similar symptoms in themselves or their family members, obtained more information about *Cyclospora* from the CDC Web site, and distributed it to other guests. All 16 guests who brought that Internet information to their physicians received appropriate treatment with TMP-SMX; symptoms resolved promptly (typically within 24 hours). Three of these 16 guests were tested for *Cyclospora,* and stool specimens were positive.

In three outbreaks (events 1, 2, and 6, Table), the index patient was tested after a suspected foodborne outbreak had been reported to the local health department by symptomatic patients (events 1 and 6, Table) or an infectious disease specialist (event 2, Table). Index patients from these three outbreaks were identified by the health department within 1 day of their laboratory verification.

In six outbreaks, patients lived in counties with ELB surveillance; 5 (83%) of these outbreaks were detected by interviewing index patients with positive specimens identified through ELB surveillance (events 3, 4, 5, 7, and 8, Table). The health departments were notified of 4 of the 5 index cases detected through ELB surveillance 3 to 6 days after laboratory confirmation.

The detection of these outbreaks was delayed primarily because the diagnosis of cases was delayed, rather than because health departments were not notified of positive laboratory results (Table). The delays in diagnosis were due to delays in seeking medical care and receiving evaluation by a physician. For example, the index patients in outbreaks 3 and 5 sought medical attention after $\geq$ 14 days of symptoms, after learning about other outbreaks of cyclosporiasis, conducting Internet searches on diagnosis and treatment, and bringing this information to their physicians; both were tested promptly. In contrast, the index patient in outbreak 6 was tested 24 days after seeking medical attention, in response to a recommendation by the local health department; this cluster of illnesses was reported to the health department when some of the patients learned about the cyclosporiasis outbreaks in the news.

The wedding outbreak investigation (event 3) best illustrates delays in clinician evaluations and effects of Internet information provided by patients on proper diagnosis and treatment (6). Thirteen (43%) of ill persons consulted physicians, and 54% of these submitted stool specimens; however, disease diagnosis was delayed because none of the physicians ordered specific laboratory testing that could identify *Cyclospora* (3). Patients were not tested until media attention about other clusters of cyclosporiasis in the United States led the bride and ill guests to conduct Internet searches.

Conclusions

The role that the media and Internet information played in testing for *Cyclospora* in these outbreaks was striking. Most index patients prompted their physicians to test for *Cyclospora* by providing them with Internet or media information. At least seven of the ill wedding guests contacted their physicians several times over a 2- to 3-week period but were not tested or treated properly until they provided information on *Cyclospora*. The two index patients who did not have a delay in diagnosis were prompted by widespread media reports to seek both Internet information on *Cyclospora* and medical attention. In the only instance in which appropriate testing was ordered without prompting by the patient or the health department, the physician had watched a television report on cyclosporiasis that morning.

Several factors can contribute to delays in testing for *Cyclospora,* and all of these factors were noted in the wedding outbreak. Persons with diarrheal illnesses often do not seek medical attention; 57% of ill persons in the wedding outbreak did not. Since *Cyclospora* is a new infection, many physicians are not familiar with its symptoms and treatment. Physicians often do not request testing of stool; 46% of ill persons who sought medical care in the wedding outbreak did not have any stool testing.

Detection of cases not only influences detection of clusters but also prompts appropriate medical treatment with TMP-SMX. When a clinical decision is made to assess a patient for a parasitic gastrointestinal infection (e.g., patients with prolonged diarrhea), clinicians should order both routine ova and parasite examination and specific testing for *Cyclospora* and *Cryptosporidium*. Laboratory-confirmed cases should be promptly reported so that outbreaks can be detected and investigated, ongoing transmission can be interrupted, and other ill persons can be provided with effective treatment. Because symptoms can be prolonged, investigation even 1 month after a common event can lead to effective treatment.

Cyclospora is not yet reportable in California; however, clinicians are required to report all unusual diseases and outbreaks to the local health departments. Nevertheless, diseases that are not reportable are rarely reported. Therefore, *Cyclospora* outbreaks identified through ELB surveillance (83% of outbreaks that involved residents of the counties with this surveillance system) might not have been detected without enhanced surveillance.

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Dr. Mohle-Boetani is a medical epidemiologist in the Disease Investigations and Surveillance Branch of the Division of Communicable Disease Control, California Department of Health Services, Berkeley, California. Her areas of expertise include outbreak investigation, cost-effectiveness analysis, and surveillance of infectious diseases.

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