A Rapid Public Health Response to a Cryptic Outbreak of Cholera in Hawaii

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Introduction

In 1991, pandemic cholera completed its encirclement of the globe; 59 countries reported 594,694 cases, more cases from more countries than in any previous year since surveillance began.1 Cholera has since been acquired in the United States through a variety of foods, including Ecuadorian crab,2,3 Thai coconut milk,4 domestic shellfish,5 and seafood salad on an international flight.6

On October 30, 1991, a private laboratory reported a suspected case of cholera to the Hawaii Department of Health; on November 1, a hospital laboratory reported a second suspected case. Both patients lived on Oahu; neither had traveled outside of Hawaii. Both isolates were confirmed by the health department to be Vibrio cholerae O1 and by the Centers for Disease Control as toxigenic V cholerae O1, biotype El Tor, serotype Ogawa. Cholera had not been acquired in Hawaii since 1895.

Methods

Cholera Patient Assessment

Within 24 hours of reporting, complete symptom, food, and travel histories were obtained from the patients and their families. Rectal swabs and sera were collected from patients and from persons with whom they had shared food during the week before illness. Restaurants and retailers where patients had purchased food, and seafood distributors that supplied these outlets, were inspected.

Patients' isolates of V cholerae O1 were compared with 204 isolates of V cholerae O1 from around the world by ribotyping7 and with 178 isolates by pulsed-field gel electrophoresis (PFGE).8 Electrophoretic type was determined by multilocus enzyme electrophoresis.9 Vibriocidal antibody titers were measured.10,11

Heightened Surveillance for Other Cholera Cases

The timetable for heightened surveillance is shown in Figure 1. On November 5, the Hawaii Department of Health notified all physicians in Hawaii that cholera had occurred, outlined methods for cholera diagnosis and treatment, and requested immediate reporting of suspected cholera cases. The following day, the department issued a news release encouraging all persons with severe diarrhea to see a physician.

On November 8, the health department asked all clinical laboratories in Hawaii to culture diarrheal stool specimens from persons 5 years old and older for V cholerae O1 on thiosulfate citrate bile-salts sucrose (TCBS) medium. Methods for isolation and identification of V cholerae O1 were described, and TCBS medium and alkaline peptone water were offered.

In mid-November, we reviewed emergency room records from civilian medical hospitals on Oahu for persons presenting with diarrhea or gastroenteritis from 1 week before to 2 weeks after onset of the two confirmed cases. Persons suspected of having cholera—persons 5 years old and older with nonbloody diarrhea (three or more loose stools in 24 hours) lasting less than 10 days—were identified through hospital chart review. We attempted to interview and obtain sera from all such persons. Moore swabs were placed in influent lines of 12 major Oahu sewage treatment plants on November 7–11, November 16–17, and December 6–8. The swabs were removed after 24 hours and cultured for V cholerae O1.12
Results

Cholera Patient Assessment

Patient A was a 78-year-old man who had had a gastrectomy in 1973. On October 24, 1991, he developed frequent watery stools; 4 days later, he required hospitalization and intravenous therapy for severe diarrhea and vomiting. He was discharged on November 6.

Patient A's vibriocidal antibody titers were 1:10 240 on November 6 and 1:5120 on November 26. No family members were ill; rectal swabs obtained from them on October 31 did not yield *V. cholerae* O1 and their vibriocidal antibody titers were 1:160 or lower, suggesting no *V. cholerae* exposure.

In the week before illness onset, patient A had eaten only one meal without his family—a fishcake stir-fry at a local diner several hours before the onset of his diarrhea. Diner employees denied being ill and were unaware of any illness among customers. Employees' vibriocidal antibody titers were 1:640 or lower, making recent *V. cholerae* O1 infection unlikely. The patient had eaten only two other seafood items in the week before onset—raw marlin sashimi and homemade canned tuna salad, both also eaten by his family.

Patient B was a 63-year-old woman who took prednisone and H2 blockers and lived with her husband on the opposite side of Oahu from patient A. On October 24, she experienced cramps and mild diarrhea. On October 29, she began a 16-day hospitalization for treatment of profuse watery diarrhea, vomiting, and dehydration.

During the week before onset, patient B and her husband ate raw fish (tuna, salmon, and partially dried tuna sticks), cooked shrimp, and canned tuna.

Patient B's vibriocidal antibody titers were 1:5120 on November 6 and 1:1280 on November 25. A rectal swab collected from patient B's husband on November 2 did not yield *V. cholerae*; however, his vibriocidal antibody titer decreased by three fourths, from 1:1280 on November 8 to 1:320 on November 25. Although he remained asymptomatic, these titers indicated recent *V. cholerae* O1 infection.

*V. cholerae* O1 isolates from patients A and B were both electrophoretic type 3 and were of the same unique ribotype (6b) and PFGE type (25b), suggesting that the infections had a common source. Of all tested strains, those most closely related to the Hawaiian isolates by ribotyping (type 6c) and PFGE (type 25b) were isolated in 1992 from three unrelated travelers who acquired their infections in the Philippines.8

Patients A and B had no water source in common and denied purchasing foods from the same retailers. In the week before illness they had consumed only four items in common: raw fish, commercially produced mayonnaise, soy sauce, and canned tuna. The last three items are unlikely vehicles for *V. cholerae* O1.

Because undercooked seafood is often implicated in cholera outbreaks,3,5,6 fresh seafoods were traced back; five wholesale distributors were common to both patients. Site visits confirmed the possibility of seafood cross-contamination; however, employees at all five distributors denied having diarrheal illness, and environmental swabs at three failed to recover *V. cholerae* O1. Most of the fresh fish sold in Hawaii is caught locally, but a small proportion of some species, including various types of tuna, is imported from the South Pacific and from Southeast Asia (telephone communication, Frank Goto, manager, United Fishing Agency Ltd, Honolulu, Hawaii, 1992).

Heightened Surveillance for Other Cholera Cases

Between November 6 and December 11, physicians reported six suspected cases of cholera. Vibriocidal antibody titers obtained from five patients did not support the diagnosis. By November 18, all major clinical laboratories in Hawaii were using TCBS medium. No *V. cholerae* O1 were isolated from 688 stool specimens cultured through December 6. Between October 17 and November 7, 78 patients sought treatment for cholera-like illness; 60 (77%) were contacted; 46 (59%) agreed to a blood test. All vibriocidal antibody titers were lower than 1:640 in sera collected between 14 and 33 days after illness onset, making infection with *V. cholerae* O1 unlikely. None of the 36 Moore swabs from sewage treatment plants yielded *V. cholerae* O1.

The estimated cost of heightened surveillance from November 5 through December 8 was $5816 (Table 1). Moore swab and laboratory surveillance alone cost approximately $2206.

Discussion

Cholera remains a serious sporadic illness in countries where it is not endemic, often catching medical and public health workers by surprise. The occurrence of cholera in a nonendemic area warrants a rapid public health response to identify cases, determine the source of infection, implement appropriate interventions, and reassure the population. In Hawaii, our methods showed inexpensively and efficiently that the outbreak was small and had ended. The health department was able to reassure residents and tourists that food and water in Hawaii could be consumed safely and that special precautions to reduce the risk of acquiring cholera were unnecessary. Although direct benefits are difficult to measure, the cholera outbreak had no perceived effect
on tourism, the mainstay of the Hawaiian economy.

Both patients had decreased gastric acid production that increased their risk of illness following low-dose exposures. The food histories and laboratory results suggest contaminated fresh seafood from Southeast Asia as a possible common source; however, the actual source of infection remains unknown.

The organized response to a suspected case of cholera begins with a report from an alert clinician or laboratory worker. Persons with suspected cholera should be swiftly interviewed by public health professionals, and diagnostic specimens should be collected as needed. Cultures may be negative if obtained 5 or more days after illness onset or after antibiotic therapy. In these cases, a 75% decrease in vibriocidal antibody titer in paired acute and convalescent sera or a single titer greater than 1:640 can be used to document infection; a titer of 1:640 or lower between 10 and 30 days after onset makes infection less likely. 10,11,13

Because the incubation period for cholera ranges from several hours to 5 days, a patient's having traveled to an endemic area from 1 to 5 days before illness onset suggests that exposure occurred there. 12 Imported cases of cholera pose little risk of transmission if the patients' homes are connected to sewage treatment systems. Cholera patients who have not traveled represent a more serious public health challenge; until the source of infection is determined and appropriate interventions are undertaken, more illnesses may occur and tourism and other economic sectors may suffer. An exposure history for the 5 days preceding illness onset may suggest the source of the infection; interviews with and diagnostic specimens from persons with whom the patient has shared food can identify other infections.

Once a nonimported case of cholera is confirmed, a vigorous search for other cases can begin. Local physicians can be encouraged to look for and promptly report suspected cases. Local media can be informed that an investigation is under way, that cholera treatment is simple and effective, and that patients with acute, severe diarrhea require urgent medical care. This initial media alert and regular progress reports will stimulate case finding, reduce morbidity, and prevent misconceptions.

Most laboratories will readily culture diarrheal stool specimens for V cholerae; laboratory testing is an inexpensive, effective surveillance method that will leave materials and experienced technicians in place after heightened surveillance has ended. Moore swab sampling of sewage treatment plant influent lines is another proven method of detecting the presence of V cholerae. 12 Prospective surveillance may be continued until the health department is confident that no new infections are occurring.

As in Hawaii, a retrospective search for cases completes the investigation. Patients who sought treatment for diarrhea during the same time period as persons with confirmed cases can be identified through emergency room and hospital chart reviews. The nature and severity of the diarrhea may help classify patients as more or less likely to have had cholera. Persons suspected of having cholera should be interviewed about recent illness and exposure histories for the 5-day period preceding onset. Serologic studies are particularly useful for retrospective evaluations.10,11,13

In Hawaii, although no single food was implicated, the most likely sources were traced back to identify potential common sources of contamination. When possible, hypotheses about potential sources of infection should be tested in a matched case-control study.14 Care should be taken not to implicate a potential source of infection without first assessing the prevalence of exposure to this source among the uninfected population.

If a food is implicated as a source of cholera, the Food and Drug Administration will assist in warning manufacturers, distributors, retailers, and the public and in removing the contaminated product from circulation. In refrigerated samples of suspected foods, polymerase chain reactions may document the presence of toxigenic V cholerae even if cultures are negative.2,3

In Hawaii, heightened surveillance did not identify additional cases, suggesting that the outbreak was small and that further transmission from the unidentified source did not occur. Given the ongoing global pandemic of cholera, other outbreaks in nondendemic areas are inevitable. Health departments should be prepared to react quickly and confidently to these emergencies.
A Decline in HIV-Infected Needles Returned to New Haven’s Needle Exchange Program: Client Shift or Needle Exchange?

Edward H. Kaplan, PhD, Kaveh Khoshnood, MPH, and Robert Heimer, PhD

Introduction

The New Haven needle exchange program experienced a significant decline in the fraction of returned needles containing human immunodeficiency virus 1 (HIV-1) proviral DNA. Is this decline due to the operations of the needle exchange or to a shift in clients? Analysis of demographic and behavioral data revealed that only one variable, the race of participating clients, changed significantly over time. However, HIV-1 prevalences in needles given to Whites and to non-Whites were not statistically different. Thus, client shift cannot be responsible for the decline in the observed HIV prevalence in needles. Instead, needle circulation times were a significant predictor of HIV prevalence. (Am J Public Health. 1994;84:1991–1994)

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References


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Editor’s Note. See related editorial by Vlahov and Brookmeyer (p 1889) in this issue.