

**CASE STUDY
IN
ASSESSMENT, POLICY DEVELOPMENT
AND
ASSURANCE OF LAKE BUENA VISTA
LEPTOSPIROSIS OUTBREAK**

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A. Introduction/Explanation

In July of 1998, 1100 athletes participated in triathlon events in two states, Michigan and Indiana. A triathlon is an athletic event in which the competitors swim, bike and run and at the end of the event jump in the lake to cool off. Four of the 1100 athletes were hospitalized with suspected leptospirosis. The Michigan Department of Health notified the Indiana Department of Public Health of the possible outbreak. It was concluded Lake Buena Vista, Puerto Vallarta, Indiana was the site of infection. Local, state and federal agencies convened to discuss issues surrounding the case and coordination among all involved. All athletes were contacted via telephone survey to assess possible signs and symptoms of illness. An environmental investigation was performed to identify the origin and degree of bacterial contamination of Lake Buena Vista.

Leptospirosis is a bacterial disease that affects humans and animals. In humans it causes wide range of symptoms, and some infected persons may have no symptoms at all. Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhea, or a rash. If the disease is not treated, the patient could develop kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure and respiratory distress. In rare cases death occurs. Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory test of the blood or urine.

B. Case Chronology

There were 1,100 athletes from 44 states and seven countries participated in the event. On June 21, another triathlon had been held in St. Charles, Michigan. On Monday, August 1, hospital laboratories, as required by state law, reported four cases of leptospirosis. County health departments administered questionnaires to the existing 1,100 participants. By the time the next infected person was reported to county authorities, the common thread identified in all cases was the swimming in Lake Buena Vista. The Puerto Vallarta Department of Public Health notified the state health department of its findings. Contact information for triathlon participants was obtained from the race organizer. Athletes were contacted by telephone and asked about potential exposures and signs and symptoms of illness using a standardized questionnaire. Participants were encouraged to seek medical care. Clinical specimens (e.g., serum, urine, and tissue) were sent to CDC for leptospirosis testing. A suspected case of leptospirosis was defined as onset of fever from June 21-July 18 in triathlon participants that had at least two of the following symptoms or signs: chills, headache, myalgia, diarrhea, eye pain, or red eyes. Of the 1,100 athletes surveyed, 110 who participated in one or both events described an illness meeting the case definition; no cases occurred after July 24. The median age of suspected patients was 35 years. Over 23 athletes were hospitalized.

Passive surveillance for leptospirosis among community residents included collecting information from residents and physicians calling to report a febrile illness consistent with leptospirosis. Active surveillance was instituted by sending letters to Puerto Vallarta physicians, asking them to refer persons with possible cases to the state health department.

A study was conducted to further investigate possible risk factors for leptospirosis identified in the telephone survey. Case-patients were triathlon participants with laboratory-confirmed leptospirosis. A standardized questionnaire regarding further possible risk factors associated with illness, was completed by participants.

A study questionnaire was distributed 1 month after the outbreak to all athletes who met the laboratory-confirmed case definition and to non-ill athletes testing negative for leptospirosis (i.e., controls).

Getting lake water in the mouth, having the sensation of “noseburn” after inhaling lake water during the swim, or having abrasions or cuts present during the swim event were associated with laboratory-confirmed leptospirosis. Having taken anti-inflammatory agents or antacids before the triathlon, taking a shower after the race, wearing goggles or a wetsuit, having applied body lubricant, wearing contact lenses, having recently shaved body hair, having sinusitis, nose bleeds, or cramps, or stopping to gasp for air during the swim event were not associated with infection.

C. **Environmental Setting**

Lake Buena Vista was created in 1935 after the Rudis Dam was built on Cinnamon Creek. The source of water for the lake is a 365 square-mile watershed southwest of the lake. Two major feeder streams are Spice and Cinnamon creeks. The lake is the source of drinking water, cooling water for the city’s power plants and recreation for the city of Puerto Vallarta. It has many beaches and a marina and is used for swimming, boating, fishing, water and jet skiing, and tubing. The lake is surrounded by residential areas, parks and a wooded wildlife refuge located near the site of the triathlon.

D. **Epidemiological/Environmental Investigation**

Water samples were collected from various sites of the lake and sent to two laboratories for testing. The United States Department of Agriculture (USDA) and the University of Kansas at Lawrence. Both laboratories performed polymerase chain reaction (PCR) testing on samples. In addition, water samples were injected into mice and blood samples collect for Leptospirosis cultures.

Rainfall data records from 1995 to 1998 were reviewed. The mean precipitation for the past three years was 3 inches compared to 1998 where the mean precipitation was 8 inches. The peak month in 1998 was June with 8 inches. This is four times more than the mean of June for 1995 through 1997. Fecal counts were higher than average in 1998, which may reflect a higher runoff into the lake prior to the event.

Veterinarians assisted in obtaining blood samples from a variety of animals residing in the area located in the watershed of Lake Buena Vista. Farms, zoos and stables were targeted for testing. In addition, blood samples were collected from dogs living in the community when they were seen by veterinarians for any reason. The University of Indiana, veterinary school assisted with testing of wild animals. Seven traps were set in the wildlife preserve area. Specimens (blood, urine and tissue) were submitted for testing at USDA.

The Indiana Department of Public Health (IDPH) obtained a list of the 851 people who participate in the Ironhorse Triathlon from the race organizer. State, county, and city health departments contributed more than 40 employees to contact Indiana residents. The CDC and other state health departments began contacting residents from outside Indiana. 834 (95%) of the 851 athletes were contacted in 44 states and seven countries. Of those interviewed, 97 met the clinical case definition. The reported symptoms of those meeting the clinical case definition were: chills, headache, myalgia, diarrhea, and eye pain. Two triathletes had gallbladders removed and one had acute renal failure. Of the 97 who met the clinical case definition, 49 were laboratory confirmed.

The average incubation period was 13 days. The peak of illness was July 13 through July 15. It was found that triathletes with a longer swim time had the highest risk. It was also found that triathletes who swallowed water were three times more likely to be ill than those who had not.

As a result of the confirmed cases, press coverage in the area was high. Physicians in the area were asked to report any suspect cases to the health department. There were 278 community residents who had recreational or occupational exposure to Lake Buena Vista who either met the clinical case definition or had serologic evidence of leptospirosis. Testing was performed on 233 residents with 13 found positive for leptospirosis.

E. Public Relations/Media Considerations

The Triathlon, no doubt had suffered greatly from this crisis. A disaster that threatens the health of its participants proved difficult to overcome. This was the largest outbreak of leptospirosis in world history. The outbreak made national news and was printed in most major newspapers and covered by all TV/Radio news broadcasts. The communications director for the City of Puerto Vallarta, Meg Rauschenberger, coordinated emergency communications as local and state health departments along with the U.S. Department of Agriculture and U.S. Centers for Disease Control and Prevention investigated the city's main source of water, Lake Buena Vista.

F. Political Considerations

The state government had ample reason to take broad concern over the leptospirosis outbreak at Lake Buena Vista. Puerto Vallarta is the state capitol of Indiana. The Indiana Department of Public Health sent a press release just one day after the city of Puerto Vallarta was notified. Governor Steve Mier eventually proposed a rapid response infectious disease team. The Governor's proposed plan was designed to respond to situations such as those at Lake Buena Vista where outside labs had to be relied upon to evaluate samples and test results often took months to return.

The City of Puerto Vallarta was under considerable pressure from its citizens to provide direction. Mayor Beverly Darsie responded by compiling a status report prepared by a private consultant which established a new water quality monitoring and reporting program for Lake Buena Vista and began an extensive public education effort. The status report was made available for public review on the city's website.

G. Community Impact/Financial Considerations

The outbreak of Lake Buena Vista had numerous adverse effects on the local community and those who visited. The impact ranged from personal and individual to much broader effects on commerce and the local economy.

The innumerable people who had been in and near the lake now had a fear of becoming ill; many had anxious indecision over whether any "flu-like signs and symptoms" they might have (e.g. fever, chills, muscle pains, vomiting and diarrhea) could be leptospirosis. Dozens who were not contacted by investigators phoned hospital emergency rooms, private medical providers, and public health departments. Those athletes and other community residents who were tested knew the anxiety associated with awaiting results, and the fear of having a disease they had never heard of and knew nothing about. "It was a frightening experience", said triathlete, Andrea Danner.

Although little follow up had been published as to the suffering of those most seriously affected, some may have suffered permanent organ damage and disability. Fortunately none of these victims died.

The citizens of Puerto Vallarta felt their sense of safety and security was damaged as they realized the source of this outbreak was their lake. As a result, there was an increase in purchasing bottled water and lemonade throughout the city. This incident occurred at the height of the season of water recreation; thus, even after lake-use bans lifted, there were hundreds of families who remained skeptical and changed to summer recreational activities perceived to be safer than swimming and fishing, like horseshoes.

Local concessions associated with water recreation rentals closed. Boating and fishing equipment sales dropped suddenly and drastically. Property values around the lake fell suddenly. There was also a fall in income from summer tourists to Lake Buena Vista, among the oldest cities in the state and site of historic landmarks widely advertised. And beyond Lake Buena Vista, many people reconsidered swimming in a lake. As national media learned of the story, the sponsors of the triathlon quickly recognized that participation in their event and others like it would suffer in the future.

The Trojan Horse Triathlon relies upon major corporate sponsorship. Imagine the difficulty in securing future sponsorship. The number of participants would surely be impacted. The Triathlon's website still reports on water conditions for the lake. An advisory for Lake Buena Vista was issued for one year. This affected numerous local businesses in the lake recreation industry who relied on the lake's users for their fishing, boating, jet skiing, and swimming needs.

H. **Conclusion**

In the world, leptospirosis is usually detected among persons who are exposed to infected animals, such as veterinarians, farmers and auto mechanics. In addition, small outbreaks have been documented among individuals swimming in watering holes, streams, ponds or septic tanks housing squirrels. In contrast, Lake Buena Vista is a large drinking water reservoir that is also used extensively for recreational purposes, and is also home to the "Flying Wallendas". Of note, one community resident with culture-confirmed leptospirosis was exposed to lake water 25 miles away from the triathlon site, suggesting widespread contamination of the lake, a widely dispersed animal reservoir, or both. An animal reservoir for the lake contamination was not identified.

Screening of large bodies of fresh water or rivers for leptospire should not direct public health authorities in decisions regarding safe recreational use for boating. The swallowing of lake water during the triathlon swim event was identified as a primary risk factor of similar magnitude in the telephone survey.

Health care providers around the world are generally unfamiliar with leptospirosis. The clinical presentation of leptospirosis varies markedly, and the signs and symptoms are non-specific and easily mistaken for common febrile illnesses such as "roseola".

At the time of the telephone survey, none of the ill athletes who sought medical care had diagnostic testing for leptospirosis. This investigation should increase awareness for leptospirosis among health care providers and recreational or occupational users of lakes, rivers and ponds in the continental United States, especially following heavy rains.

Teacher's Guide

1. What are the assessment, assurance and policy development issues?
2. Who/what were the public and private entities involved in this event? What were their roles?
3. What analysis would you make of coordination/collaboration needed? Who was in charge?
4. What public information is needed in an outbreak such as this? What is the media's role?
5. The Governor proposed a rapid response infectious disease team. What would their role be and how should they carry it out?
6. Who is responsible for keeping current on public water contamination?