Legionnaires' Disease Outbreak at the Rio All-Suites Hotel and Casino, 2017 Las Vegas, Nevada

PUBLIC HEALTH INVESTIGATION FINAL REPORT

Southern Nevada Health District
OFFICE OF EPIDEMIOLOGY AND DISEASE SURVEILLANCE | LAS VEGAS, NEVADA

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INTRODUCTION:

On April 27, 2017, the Southern Nevada Health District (SNHD) received a report from an out-of-state local health department of a person (Case #1), diagnosed with Legionnaires' disease, who had stayed at the Rio All Suites Hotel and Casino (Rio) during the incubation period of the disease.

In response to this report, SNHD's Office of Epidemiology and Disease Surveillance (OEDS) partnered with SNHD's Environmental Health (EH) Division team and began an initial investigation/inspection on May 2, 2017.

During the original EH inspection, facility representatives were educated on water management plans and water sampling. The Rio agreed to test the recommended sites. The following day the EH team accompanied the Rio's water management representatives to observe the sampling process. Environmental testing in the hotel water system subsequent to the first case report was positive for *Legionella pneumophila* serogroup 1 (Lp1), and fluorescent *Legionella*.

On May 23, 2017, the Centers for Disease Control and Prevention (CDC) Respiratory Diseases Branch, as part of the national surveillance system to detect cases among travelers, informed SNHD of a second case (Case #2) of laboratory-confirmed Legionnaires' disease in a person who had also stayed at the Rio during the incubation period. Case #1 had illness onset in March and Case #2 had illness onset in April 2017, approximately one month apart. Both cases were laboratory confirmed through urine antigen testing; no culture isolates from cases were available.

Environmental testing on specimens collected by SNHD on May 24, 2017 were positive for *Legionella pneumophila* serogroup 4 (Lp4) in 25 of 31 samples.

Based on the *SNHD Protocol for Legionella Investigations*, an outbreak is declared when two or more cases are associated with the same facility whereby environmental evidence suggests a common source of infection. The CDC was contacted for guidance. An outbreak investigation was initiated on June 7, 2017. The primary objective of this outbreak investigation was to identify the source(s) of infection, eliminate the source of infection, and to prevent additional cases.

BACKGROUND:

Legionnaires' disease is a bacterial disease that can cause respiratory illness or pneumonia. About 6,000 cases of Legionnaires' disease were reported in the United States in 2015. However, because Legionnaires' disease is likely underdiagnosed, this number may underestimate the true burden of disease. This disease is a reportable infection and is commonly investigated for travel-related exposures. People can acquire the infection by breathing small water droplets in the air that contain the bacteria called *Legionella*. *Legionella* is a type of bacterium that is naturally found in fresh water environments, like lakes and streams, but it can become a public health problem when found in human made water systems such as cooling towers, hot tubs, showers, faucets, decorative fountains, water features, and large plumbing systems.

Legionellosis can be difficult to diagnose in ill individuals because the symptoms are similar to other respiratory diseases and can include cough, shortness of breath, fever, muscle aches, and headaches. These symptoms usually begin 2 to 10 days after being exposed to the bacteria, but they can take longer. Diagnostic testing can be done by a physician if they order tests on urine or sputum samples. Legionnaire's disease can be serious, but it can also be treated with antibiotics. Those most at risk for developing illness after being exposed are those who are current or former smokers, have a chronic lung disease, and/or have a weakened immune system.

INVESTIGATION METHODS:

Epidemiologic

The office of Epidemiology and Disease Surveillance staff conducted an initial site visit to the Rio Hotel on May 2, 2017. OEDS confirmed Case #1's stay and review the hotel guest list to obtain the room number. After receiving the notification from the CDC of Case #2, OEDS contacted the local health department of the state in which the case resided, to obtain room information. On May 24, 2017, a second site visit was conducted and the Rio Management was informed of the second case reported. The stay of Case #2 was confirmed and the room number was obtained.

The Nevada Division of Public and Behavioral Health (NVDPBH) Office of Public Health Informatics and Epidemiology (OPHIE) was informed about the outbreak investigation on June 6, 2017, once preliminary environmental results were available.

SNHD contacted the CDC Legionellosis Branch via email on June 6, 2017. OEDS requested a conference call to provide an overview of the current situation and discuss next steps in the investigation. OEDS continued to receive technical assistance from the CDC. Conference calls with the CDC *Legionella* staff occurred on August 7 and August 25, 2017, with subsequent periodic email and phone communications.

Case Definitions:

Confirmed Legionnaires' disease Case:

A person who stayed overnight, worked at least one shift, or attended a convention or multi-day event at the Rio from March 1 to September 21, 2017 and:

- Became ill between two days after arriving and 14 days after leaving, **AND**
- Had positive laboratory testing for *Legionella pneumophila*, including isolation (by culture) of any *Legionella* organism (from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid), by detection of *L. pneumophila* serogroup 1 antigen in urine using validated reagents, or by seroconversion (fourfold or greater rise in specific serum antibody), **AND** met one of the following clinical criteria:
  - Received care (as an inpatient or outpatient) for one or more symptoms consistent with pneumonia (fever equal or greater than 101° F, chills, cough, fatigue, or weakness) **OR**
  - Received antimicrobial treatment* that is effective against *Legionella* and no other pneumonia causing organism was isolated **OR**
  - Had radiographically confirmed pneumonia.

If any criteria for the definition are unknown (e.g., receipt of antibiotics) and the case otherwise meets the definition, assume that the missing criteria exists for investigation purposes.

Suspect Legionnaires' disease Case:

A person who stayed overnight, worked at least one shift, or attended a convention or a multi-day event at Rio from March 1 to September 21, 2017 and:

- Became ill between two days after arriving and 14 days after leaving, **AND**
- Had no laboratory testing for *L. pneumophila* or a negative urine antigen test for LP1 **AND** met one of the following clinical criteria:
  - Had a positive PCR test for *L. pneumophila* (these are sometimes conducted at the level of the hospital) **OR**
  - Had a fourfold or greater rise in antibody titer to specific species or serogroups of *Legionella* other than *L. pneumophila* serogroup 1 **OR**
  - Had detection of specific *Legionella* antigen or staining of the organism in respiratory secretions, lung tissue, or pleural fluid by direct fluorescent antibody (DFA) staining, immunihistochemistry (IHC), or other similar method using validated reagents. **OR**
  - Received care (as an inpatient or outpatient) for fever equal or greater than 101° F and one or more symptoms consistent with pneumonia (chills, cough, fatigue or weakness) and received antimicrobial treatment* that is effective against *Legionella* and no other pneumonia causing organism was isolated s/a *S. pneumoniae*, and did not have a radiological test for pneumonia **OR**
  - Had clinical or radiographic pneumonia.

Confirmed Pontiac Fever Case:

A person who stayed overnight, worked at least one shift, or attended a convention or multi-day event at the Rio from March 1 to September 21, 2017 and:

- Became ill between five hours after arriving and three days after leaving, **AND**
- Had positive laboratory testing for *Legionella pneumophila* serogroup 1, by detection of *L. pneumophila* serogroup 1 antigen in urine using validated reagents, or by seroconversion (fourfold or greater rise in specific serum antibody), **AND**
  - Had a fever and one or more of the following symptoms; chills, cough, myalgia, or fatigue.

Suspect Pontiac Fever Case:

A person who stayed overnight, worked at least one shift or attended a convention or multi-day event at the Rio from March 1 to September 21, 2017 and:

- Became ill (fever and one of the following - chills, cough, myalgia, or fatigue) between five hours after arriving and three days after leaving, **AND**
- Had negative or no laboratory testing for *Legionella pneumophila* serogroup 1, in urine using validated reagents, **AND**
  - Had no positive tests for other URI agents in the appropriate time frame **OR**
- Did not seek medical care at time of illness, but reported having a fever and one or more of the following symptoms:
  - Chills, cough, myalgia, or fatigue

*Recommended treatment is either a respiratory fluoroquinolone, such as levofloxacin or a macrolide (azithromycin). Doxycycline and trimethoprim-sulfamethoxazole are alternative drugs (Red Book, 30th edition 2015.

Case Finding:

SNHD began case finding efforts on June 8, 2017. A secure notification was distributed to public health professionals across the United States on the same day, requesting states to report to SNHD cases of Legionnaire's disease associated with travel to Las Vegas. A press release was issued on Friday, June 9, 2017, and posted to the SNHD website. The Rocky Mountain Poison and Drug Center (RMPDC) phone line was activated to field calls associated with this event because a high call volume was anticipated. A frequently asked questions (FAQ) document was developed and forwarded to RMPDC representatives. RMPDC staff was instructed to forward calls from healthcare providers immediately to OEDS. Calls from persons reporting illness were referred to OEDS via email and assigned to investigators for follow-up. Callers were asked to confirm their dates of stay at the facility and were requested to provide medical records to verify illness meeting the confirmed outbreak case definitions.

Rio management sent letters to all guests staying at its facility between March 1 and June 22, 2017. The letters informed guests of their possible exposure risk and recommended they seek medical attention if they became ill with symptoms of legionellosis within 14 days of their stay. Additionally, the Rio sent a second round of notification letters to its guests that stayed at its facility between June 22 and September 21, 2017 (the date when the sampling detected no more presence of *Legionella*). A web link to the SNHD Legionellosis FAQ and an SNHD INFO line phone number was contained within the letters.

A survey to identify cases of Legionnaires' disease or Pontiac fever was designed and the link to the survey was posted to the SNHD FAQ website regarding this outbreak. Those who received the letters from the Rio could access the survey by checking the web link or by calling the help line, both of which were included in the letters.

Microbiological

All confirmed cases of Legionnaires' disease associated with this outbreak were laboratory confirmed using urine antigen testing.

Environmental water collection and sampling conducted by SNHD, utilized the CDC's "Protocol for collecting environmental samples for *Legionella* culture during a cluster or outbreak investigation or when cases of disease may be associated with a facility" as a guide. Samples were collected by SNHD's EH staff and samples were shipped to EMSL Analytical, Inc. for *legionella* testing.

Additional water samples were collected and tested by a third-party water management consultant.

Environmental

Environmental Health staff accompanied OEDS staff to the Rio Hotel on May 2, 2017 for an initial site visit. On May 3, 2017, an EH Specialist accompanied the Rio's facility staff as water samples were collected for *legionella* testing. Samples were obtained from the room where Case #1 stayed, a room at the distal end of the hot water loop serving the guest room, and the hot water return furthest from the heat source. In total, 14 environmental samples of the hot water system were taken.

On May 23, 2017, SNHD OEDS notified EH regarding the additional case report (Case #2) and a team was dispatched on May 24, 2017 to obtain water samples from fixtures within the room where Case #2 stayed. EH staff conducted an environmental assessment, requested various records from the facility including the sampling the facility conducted subsequent to the first case report on May 2, 2017. EH staff then conducted sampling of

the room where Case #2 stayed and a room on the floor furthest from the hot water source. Environmental swabs were collected from the interior of the bathroom sink, shower, and lavatory fixtures. Because both cases reported using the spas located in the Men's Health Spa, samples of the water were taken along with swab samples taken from the tile line of each of the two spas.

On May 25, 2017, EH staff conducted a complete survey of the facility. This included reviewing the plant used to create hot water, the cooling towers, the outdoor pools and spas, and the misting systems.

On June 1, 2017, EH staff advised the facility to remediate the water systems of Tower 1, based on lab results from initial samples.

On June 13, 2017, EH staff accompanied Rio's water management consultant during post-remediation water testing.

On June 16, 2017, OEDS received additional information from the LHD of Case #2. This case was confirmed to have stayed in a different tower from Case # 1. The Rio was then contacted by EH and advised to begin remediation of that tower immediately.

On August 8, 2017, EH staff conducted sampling of the Men's Health Spa, Women's Health Spa, and outdoor Spas. In total, 24 water samples and swab samples were taken.

On August 26, 2017 the facility remediated the Men's Spa 1 area based on lab results from samples taken on August 8, 2017.

RESULTS:

Epidemiologic Results:

Call Center Results:
SNHD anticipated a high volume of incoming calls after the release of the first Rio notification letters and the media release on June 9, 2017. The SNHD INFO line was activated and available on June 12 and was de-activated on August 18, 2017. The call volume during that time totaled approximately 534 total calls into the INFO line. Callers who indicated signs or symptoms of Legionnaires' disease or that had additional questions were referred to OEDS for follow up.

Case Finding Results:

As of January 2, 2018, when the online survey was closed, OEDS received 398 responses from the online survey, 214 of which were completed (Rio guests with contact phone numbers and/or emails present). The completed records were screened by a data management algorithm developed from the case definitions and programmed in SAS 9.4. Records that were deemed to possibly meet the case definitions were then forwarded to the Disease Investigation and Intervention Specialists (DIIS) for further interview and evaluation. With responses from the online survey and phone calls combined, OEDS investigated 279 possible cases, seven of which were identified as confirmed Legionnaire's disease, 31 were classified as suspect Legionnaire's disease and 69 were classified as suspect Pontiac Fever. The last confirmed case associated with this outbreak reported a stay in June 2017.

The epidemiological curve for this outbreak is shown in Figure 1 below.

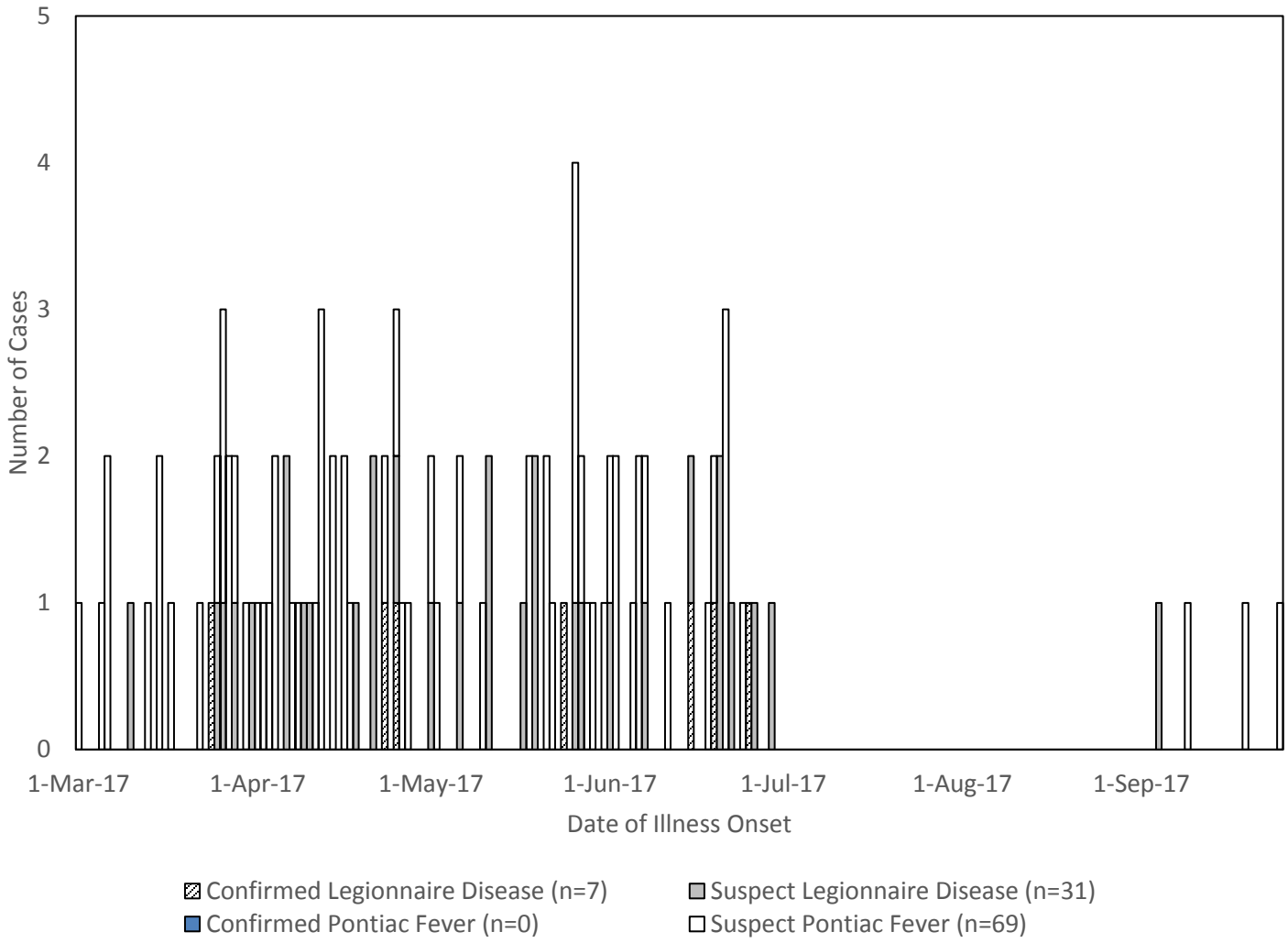

Figure 1: Onset of Illness for Cases Associated with Staying at Rio All-Suite Hotel and Casino March 1, 2017 to September 21, 2017 (N=107)

Environmental Results:

During the environmental investigation on May 25, the Rio reported that work had been done on the hot water systems that supplied the hot water to the rooms where the two reported cases stayed. Both hot water systems were replaced in January and February of 2017. During this repair, rooms were taken offline for three days. The reported process after the hot water system repairs was to turn on the new systems, raise the temperature to 140 degrees Fahrenheit, and flush the water pipes. The Rio representatives said that the flushing of each fixture took 12 hours. After the testing on May 4, the Rio representative reported that the rooms would be remediated during the next week by raising the temperature to 140 degrees Fahrenheit, flushing all taps with a trickle of water for 12 hours, and then return the system to service.

SNHD received results of testing by the Rio that found *Legionella pneumophila* serogroup 1 present in the facility. Locations included a fountain, the hot water return, and guest rooms. SNHD was made aware that the Rio would begin a chlorine based disinfection process for remediation of the water systems. On June 8, 2017, the facility hyper-chlorinated each water system of tower 1 at a target concentration of 50ppm chlorine. Disinfection of the system was completed during the morning of June 11. On June 12 and June 13, 2017, SNHD EH staff observed the facility conduct sampling in the guest rooms of the disinfected tower. On June 21, the facility hyper-chlorinated each water system of tower 2 at a concentration of 50ppm chlorine. Disinfection of the system was completed on June 23, 2017. On August 26, 2017, the facility hyper-chlorinated the men's spa 1 area. Disinfection of the system was completed on August 28, 2017.

Environmental water sampling results from the Rio, throughout the investigation are indicated in Table 1 below:

Table 1: Summary Environmental Water Sampling Results

Date of sampling	Number of samples detecting *Legionella spp.*
05/03/2017	9 of 14
05/24/2017	25 of 31
06/12/2017	0 of 15
06/27/2017	1 of 12
07/19/2017	8 of 35
08/01/2017	9 of 35
08/08/2017	2 of 24
08/14/2017	3 of 44
08/28/2017	8 of 45
09/21/2017	0 of 10

CONCLUSION/DISCUSSION:

The causative agent of this outbreak was identified as *Legionella pneumophila* and confirmed to be present throughout the property over a span of several months. Unfortunately, the diagnosing providers did not collect cultures from the cases so that biological samples could be conclusively matched with environmental samples. Since mode of transmission is inhalation of water droplets, risk factors would be any activity at the property that could expose people to water spray such as showering, bathing, and recreational water use. Several remediation sessions were conducted with follow up testing to ensure the contamination has been eradicated.

This outbreak investigation highlights the importance of collaboration between epidemiology, environmental health, laboratory services and the hotel industry. The investigation also underlines the need for SNHD to continue educational outreach efforts in local hotels. Facilities with large scale water systems, large water features, and public hot tubs are encouraged to develop a water management plan to reduce the growth and spread of *Legionella*. The Centers for Disease Control and Prevention has created a toolkit for industry titled, "Developing a Water Management Program to Reduce *Legionella* Growth and Spread in Buildings: A Practical Guide to Implementing Industry Standards 13.2." SNHD recommendations to local facilities adhere to CDC guidelines for the prevention and control of Legionnaire's Disease.

Timely notifications of travel-associated Legionnaires' cases from other jurisdictions and from the CDC is important in reducing the response time and initiating both epidemiologic and environmental investigations. In this outbreak investigation, SNHD conducted a site visit at the Rio within 4 days of notification of the first case.

The combined effort of the Rio facility managers and SNHD staff allowed for a rapid assessment and positive confirmation of *legionella* in the water system.

Ten percent of legionellosis cases nationally reported travel during their incubation period. The Legionellosis Branch (NCIRD/DBD/RBD) at the Centers for Disease Control and Prevention has a critical role in providing notifications to local health authorities of cases that may be associated with travel. Effectively designed hotel water management plans can serve to control *Legionella* growth and prevent travel-associated legionellosis cases. Water management and legionellosis prevention are key to preventing Legionnaire's Disease Outbreaks. SNHD will continue to work closely with industry leaders in Clark County to take immediate action in preventing outbreaks.

RESOURCES:

Developing a Water Management Program to Reduce *Legionella* Growth and Spread in Buildings: A Practical Guide to Implementing Industry Standards 13.2. (2017, April 26). Last visited on March 27, 2018, from https://www.cdc.gov/legionella/maintenance/wmp-toolkit.html

Legionnaires' Disease Fact Sheet. (2016, July 18). Last visited on March 27, 2018, from https://www.cdc.gov/legionella/about/signs-symptoms.html