



MARK H. LUTTRELL, JR.
MAYOR

SHELBY COUNTY HEALTH DEPARTMENT

ALISA R. HAUSHALTER, DNP, RN
DIRECTOR

HELEN MORROW, MD, MPA
HEALTH OFFICER



Public Health
Prevent. Promote. Protect.

Legionellosis Outbreak Associated with a Hotel in Shelby County TN17-214

Background

Legionella is a type of bacterium that thrives in warm moist environments, including soil and warm water that is 75-125°F. Outbreaks are commonly associated with buildings or structures that have complex water systems, like hotels and resorts, long-term care facilities, hospitals, and cruise ships. The most likely sources of infection include water used for showering, hot tubs, decorative fountains, and cooling towers.

On June 26 and June 27, Shelby County Health Department was notified of two cases of Legionellosis in patients from Florida and the United Kingdom who both reported hotel exposures at a local Memphis hotel, and investigated a local case of Legionellosis in a Shelby County resident reporting the same exposure. Based on that initial information and the fact that all three patients reported swimming and using the hot tub at the hotel, decisions were made to close the aquatic facilities in the hotel and initiate a formal investigation.

On June 28, a 4th confirmed case was reported to Tennessee Department of Health in a Kentucky resident along with 3 other ill persons in that group of travelers, including one who died. All 4 Kentucky residents reported swimming pool and hot tub exposures. That same day, Dr. Helen Morrow issued a health directive closing the hotel pool and hot tub until further notice. The health directive further instructed the hotel to engage an environmental engineering firm familiar with CDC guidelines for conducting environmental assessments and remediation of *Legionella* to test the aquatic facilities and hot water distribution systems in the hotel. SCHD Bureau of Environmental Health staff also reviewed best practices in maintaining and testing water quality in the pool and hot tub with hotel management.

On June 29, SCHD Office of Epidemiology formally requested the hotel guest roster for the dates May 15-June 27. May 15th was the first day that the aquatic facilities were open to the general public. Also on June 29, Tennessee Department of Health was allowed by SCHD to conduct independent water sampling for PCR and culture testing at the TDH Public Health Laboratory. A REDCap survey was developed in coordination between TDH and SCHD that was deployed to gather epidemiologic and exposure information from hotel guests as part of the epidemiologic investigation. Also on June 29, Shelby County issued a press release about the outbreak and an Epi-X Alert was distributed throughout that network.

Investigation methods

Case Finding and Epidemiologic Investigation

On July 5th, the hotel provided SCHD with a list of all reservations made at the local franchise under investigation between the dates of May 15th, 2017 and June 27th, 2017. Using a modified version of CDC's Questionnaire for Legionellosis Associated with Hotel Travel, SCHD and TDH developed an interview survey for REDCap. On the same day, both e-mails and letters were sent to patrons with the REDCap survey link. Approximately 4,000 e-mails were sent to hotel guests with links to the REDCap survey on July 6th. These outreach efforts directed guests to contact SCHD by phone or email if they stayed at the hotel between May 15, 2017, and June 27, 2017, and experienced symptoms of Legionnaires' disease (cough, shortness of breath, fever, muscle aches, and headaches) following their stay.

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com

Case definition:

Confirmed Case

A person:

- With clinically compatible symptoms (fever, OR myalgia, OR cough, OR clinical/radiographic diagnosis of pneumonia)
- Who stayed at the hotel during May 15, 2017-June 27, 2017 AND
- Had onset of illness within 14 days after staying at the hotel AND
- Has a confirmatory lab test, either:
 - By culture: isolation of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid; OR
 - By detection of *Legionella pneumophila* serogroup 1 antigen in urine using validated reagents; OR
 - By seroconversion: fourfold or greater rise in specific serum antibody titer to *Legionella pneumophila* serogroup 1 using validated reagents

Probable Case

A person:

- With clinical/radiographic diagnosis of pneumonia
- Who stayed at the hotel during May 15, 2017-June 27, 2017 AND
- Had onset of illness within 14 days after staying at the hotel

Suspect Case

A person:

- With fever AND
- ≥ 1 of the following symptoms: myalgia, cough, fatigue/malaise/weakness, loss of appetite, headache, abdominal pain/cramps, diarrhea, vertigo
- Who stayed at the hotel during May 15, 2017-June 27, 2017 AND
- Had onset of illness within 14 days after staying at the hotel

Not A Case

A person:

- Without clinically compatible findings OR
- With an alternate diagnosis OR
- Who did not stay at the hotel during May 15, 2017-June 27, 2017 OR
- Who did not have onset of illness within 14 days after staying at the hotel

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com



SHELBY COUNTY HEALTH DEPARTMENT



MARK H. LUTTRELL, JR.
MAYOR

ALISA R. HAUSHALTER, DNP, RN
DIRECTOR

HELEN MORROW, MD, MPA
HEALTH OFFICER

Public Health
Prevent. Promote. Protect.

Case Counts and Survey Responses:

A total of 8 cases were identified by public health prior to the distribution of the online survey. As of 7/31/17, 983 survey responses have been received and a total of 9 confirmed, 19 probable and 64 suspect cases have been verified.

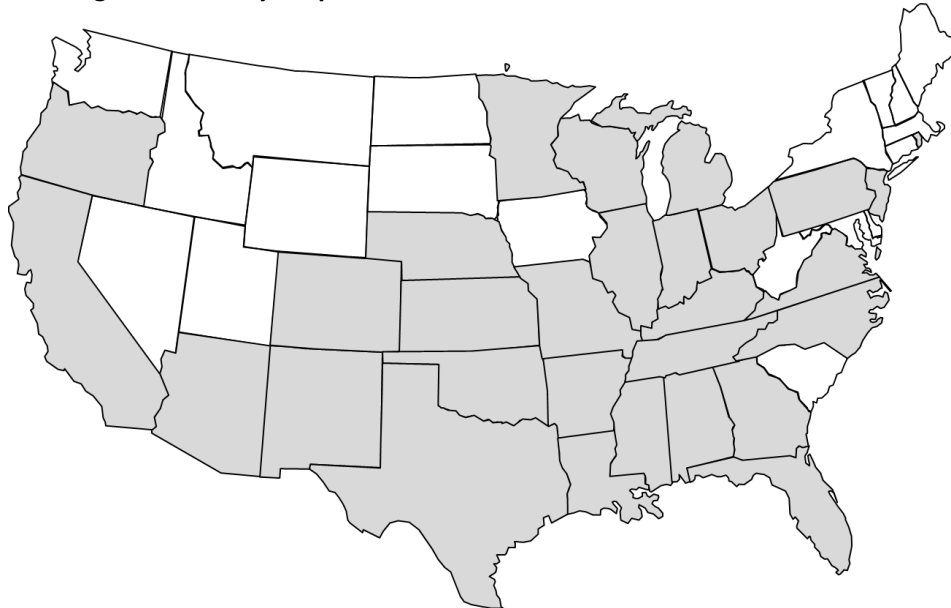
Case Characteristics (n=92):

Characteristic	Confirmed n=9	Probable n=19	Suspect n=64
Age			
Median	56 years	61 years	49.5 years
Mean	59.0 years	60.5 years	49.1 years
Range	50–69 years	37–79 years	13–81 years
Sex¹ n (%)			
Male	4 (57)	3 (21)	7 (25)
Female	3 (43)	11 (79)	21 (75)

¹For 49 (47%) of cases, sex information was unavailable

Countries of residence (n=4) include: United States, United Kingdom, Canada, and Australia

MSR Legionella Survey Respondents' State of Residence:



■ US case state of residence

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com

States of residence (n=29) include:

State	Confirmed	Probable	Suspect	Total
Alabama	0	0	2	2
Arizona	0	1	2	3
Arkansas	0	1	0	1
California	0	0	4	4
Colorado	0	1	1	2
Florida	2	1	2	5
Georgia	0	0	2	2
Illinois	0	1	2	3
Indiana	0	1	0	1
Kansas	0	0	1	1
Kentucky	2	1	4	7
Louisiana	0	0	1	1
Michigan	0	3	0	3
Minnesota	0	1	5	6
Mississippi	0	2	0	2
Missouri	0	0	1	1
Nebraska	0	0	1	1
New Jersey	0	1	1	2
New Mexico	0	0	1	1
North Carolina	0	1	2	3
Ohio	0	1	3	4
Oklahoma	0	0	2	2
Oregon	0	1	0	1
Pennsylvania	0	0	2	2
Rhode Island	0	0	1	1
Tennessee	2	0	9	11
Texas	0	0	6	6
Virginia	0	0	2	2
Wisconsin	0	0	1	1
Missing/NA	3	2	6	11
Total	9	19	64	92

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com



SHELBY COUNTY HEALTH DEPARTMENT



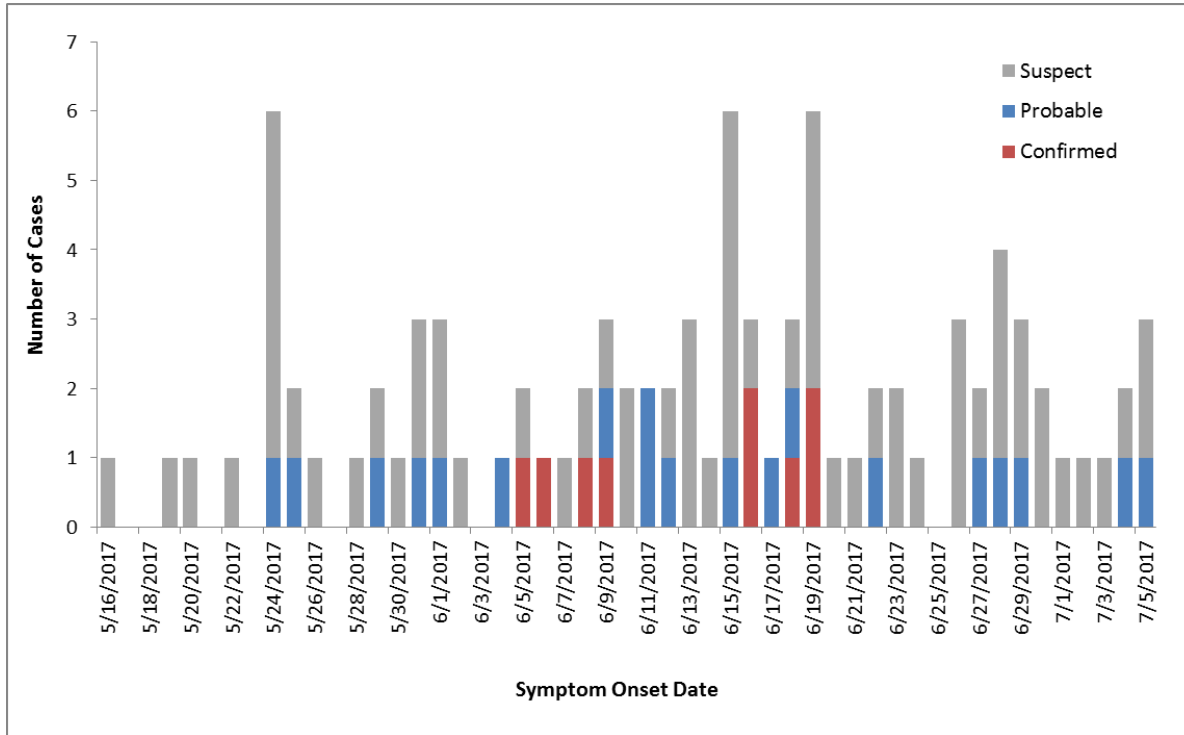
MARK H. LUTTRELL, JR.
MAYOR

ALISA R. HAUSHALTER, DNP, RN
DIRECTOR

HELEN MORROW, MD, MPA
HEALTH OFFICER

Public Health
Prevent. Promote. Protect.

Epidemic Curve:



Verification and Risk Analysis:

On Thursday, July 6, 2017 a survey was sent to hotel guests who stayed between 5/15/2017 and 6/27/2017 with available, valid email addresses (n > 4,000). On 7/31/17 the survey was closed. At that time, 983 responses had been received. From these data, a basic risk analysis was performed.

Respondents reporting a positive legionella test, pneumonia, or fever and ≥ 1 other symptom (n=118) were verified in REDCap by checking for duplicate responses, checking hotel dates were within the exposure timeframe (5/15/17 – 6/27/17), and illness onset date was prior to and within 14 days of hotel stay. Responses that did not fit these criteria (n=26) were marked as not a case and excluded from analyses.

Well persons with missing hotel stay dates, hotel dates outside of the exposure timeframe (5/15/17 – 6/27/17), hotel stay >30 days, age >100 years or missing name were excluded from the analyses (n=209).

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com

Unadjusted Analysis:

An unadjusted analysis including ill and well respondents in the REDCap database was performed. Statistically significant exposures are reported below:

Exposure	Ill*		Well		Odds Ratio	95% Confidence Interval		Fisher-exact (P-value)
	Exposed	Not Exposed	Exposed	Not Exposed		Lower Limit	Upper Limit	
Hotel Ice	55	25	309	372	2.66	1.62	4.36	<0.001
Hotel gym	15	60	56	626	2.79	1.49	5.23	0.003
Conference Center	18	57	70	612	2.76	1.54	4.95	0.002
Time in Hot Tub ^{&}	31	49	109	573	3.32	2.03	5.45	<0.001
Time near Hot Tub ^{&}	52	33	175	507	4.57	2.86	7.30	<0.001
Time in Pool ^{&}	40	46	146	536	3.19	2.01	5.06	<0.001
Time near Pool ^{&}	68	19	285	397	4.98	2.93	8.48	<0.001
Fountain Near Pool ^{&}	25	52	70	612	4.20	2.46	7.19	<0.001
Aquatics Area ^{1&}	73	19	291	391	5.16	3.05	8.75	<0.001

*Ill: included confirmed, probable and suspect cases

¹Combined aquatics area variable includes anyone reporting time in or near the pool, hot tub or fountain

[&]Association remains statistically significant when restricted to probable and confirmed cases

No Memphis-area exposures were significant. Hotel ice was no longer significant when restricted to confirmed and probable cases. All aquatics area exposures were significant when restricted to only confirmed and probable cases. The strongest association with illness in the restricted analysis was the combined aquatics area (OR: 11.2; 95% CI: 3.35 – 37.44).

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com



SHELBY COUNTY HEALTH DEPARTMENT



MARK H. LUTTRELL, JR.
MAYOR

ALISA R. HAUSHALTER, DNP, RN
DIRECTOR

HELEN MORROW, MD, MPA
HEALTH OFFICER

Public Health
Prevent. Promote. Protect.

Environmental Health Assessment and Remediation

On June 28, 2017, a representative from the hotel contacted the Center for Toxicology and Environmental Health, LLC (CTEH®) to conduct environmental sampling to determine the presence of legionella after the pool and hot tub were officially shut down by Shelby County Health Department. CTEH was requested to assist in the various aspects of expertise, testing, and remediation oversight with the goal of meeting the health department order terms and returning the client property to normal operation. On June 29, 2017, a total of 25 samples were collected; five swab samples and twenty water samples. Water samples were collected in the south building of the hotel in rooms farthest from the hot-water system boilers. Two water samples were collected from each showerhead, an initial draw and an additional draw after approximately 10 minutes running hot water. Water samples were also taken from the pool filter, hot tub filter, a sprinkler in the pool area, and at the municipal water intake to the facility. Swab samples were taken from two VTAC air conditioning units found to have visible condensate and biofilm, a sprinkler head in the pool area, a showerhead in room 296 and the ice machine in the north central cantina on the third floor. Verbal results were received from PathCon Laboratories on Friday July 7, 2017, indicating that only one sample reported a detection of Legionella bacteria. That sample was a water sample collected from the sprinkler located in a flower pot on the south side of the stairs in the pool area and reported a concentration of 1 CFU/mL of legionella bacteria. Since the line was independent of other water lines servicing the main line from the purveyor, it was recommended to seal this pipe and remove the irrigation/sprinkler system. This was completed on Saturday July 8, 2017.



Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com

On July 19th 2017, an official recission letter from Shelby County Health Department lifting the closure directive at the hotel was enacted and the aquatic facilities were reopened. This was approved after post remediation sampling demonstrated no viable or molecular DNA Legionella present.

In being able to identify the source as a device and not a potable water source, post-remediation analyses demonstrated no additional growth on any of the 26+ items sampled in and around the aquatic facility. After a review of the literature and discussions with CDC, it was deemed not necessary to mandate two successive negative sampling frames to reopen the aquatic facilities.

Conclusions

Both the Epidemiologic and Environmental Health investigations converge and agree that the hotel experienced a Legionellosis outbreak in May-June of 2017. Hotel guests with confirmed and probable Legionella infections spent more time in and around the hotel pool and hot tub than did people who did not get sick. Microbiologic testing found evidence of Legionella in landscape sprinklers and the aquatic facilities in that vicinity. The contaminated areas have been remediated and post-intervention tests came back negative for Legionella.

Recommendations

Moving forward, the hotel is required to adhere to the following:

1. Continue routine sampling on the aquatic facilities as highlighted in an official Remediation Plan submitted by the hotel and approved by the Shelby County Health Department Environmental Health Services Bureau.
2. Explore optimal water treatment protocols for the outdoor, exposed hot tub.
3. Implement their Preventive Water Maintenance Plan monthly (instead of quarterly) for the next 6 months.

Key Investigators

Shelby County Health Department:

David Sweat, Chief of Epidemiology
Tyler Zerwekh, Administrator of Environmental Health Services Bureau
Jennifer Kmet, Senior Epidemiologist
Whitney Neal, Regional Epidemiologist
Tamal Chakraverty, Environmental Epidemiologist

Tennessee Department of Health

John Dunn, Deputy State Epidemiologist
Steffany Cavallo, Epidemiologist
Jane Yackley, CSTE Applied Epidemiology Fellow

Mission

To promote, protect and improve the health and environment of all Shelby County residents.

814 Jefferson Avenue ♦ Memphis, TN 38105 ♦ 901 222-9000 ♦ www.shelbytnhealth.com