

Legionellosis Outbreak-Genesee County, June, 2014 – March, 2015

Summary Analysis

Michigan Department of Health and Human Services
Genesee County Health Department

(This report was edited on January 15, 2016 to update case information, including Legionella infection associated deaths and illness onset dates.)



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Legionellosis Outbreak — Genesee County, June 2014–March 2015

Summary

From June 2014 to March 2015, 45 legionellosis cases, all confirmed Legionnaires' disease (LD), were reported in Genesee County, Michigan. Five of these cases have died; one death was attributable to *Legionella* pneumonia. The Michigan Department of Health and Human Services (MDHHS) assisted the Genesee County Health Department (GCHD) in the investigation.

Data were collected from patient medical record review, the Michigan Disease Surveillance System case report form, and interviews with case-patients or their proxies with an enhanced legionellosis questionnaire. In an attempt to identify community sources, case-patients or proxies were interviewed about travel, work, and locations visited during the 2 weeks prior to symptom onset (considered the incubation period for LD).

All 45 cases were laboratory confirmed by *Legionella* urinary antigen test; one sputum specimen was collected, which was *Legionella* culture negative. Median patient age was 62 years (range: 26–94); 23 (51%) were male. Illness onset dates ranged from June 6, 2014 to March 9, 2015 and peaked in August, 2014 with 10 cases. Multiple attempts by phone and letter were made to contact all case-patients; interviews using the enhanced questionnaire were completed on 30 of 45 (67%).

Healthcare-associated LD was suspected for a subset of cases. Results demonstrated that over half (27/45) of the cases had a healthcare facility exposure in the two weeks prior to their illness onset (23 were hospitalized at or had visited the same healthcare facility). In response, the healthcare facility has implemented multiple environmental and procedural measures to alleviate the situation.

The source of water at the primary residence was evaluated for all cases. Twenty-one of 45 (47%) cases occurred in people whose residence received City of Flint water. Of the 18 persons that did not report healthcare visits, 8 (44%) were exposed to Flint water at their home.

Ten cases had no exposure to a Flint hospital in the 2 weeks prior to illness nor were their homes on the Flint water system.

Other possible exposures were evaluated and no other known community exposures were identified.

Enhanced surveillance has continued for the remainder of 2015. All cases reported in 2015 will be summarized at year end. The lack of clinical *Legionella* isolates during the time period described in this summary precludes our ability to link cases to an environmental source. MDHHS has recommended vigilant legionellosis awareness and surveillance in Genesee County, including interviewing of cases or proxies with the enhanced legionellosis questionnaire within one week of reporting. MDHHS also recommends the clinical community assist in LD surveillance through accurate identification, testing, and reporting of all suspect cases. Obtaining respiratory specimens in addition to urinary antigen testing is of critical importance in these increased surveillance efforts. Because *Legionella* spp. are commonly found in the environment, clinical isolates are necessary to interpret the findings of an environmental investigation in an outbreak. To assist, MDHHS prepared updated legionellosis guidance to be distributed to health care providers via the Michigan Health Alert Network.



Working Case Definitions

Confirmed Legionnaires' Disease (LD) – meets the CDC clinical and laboratory case definition for confirmed LD and illness occurred since June 1, 2014 in residents of Genesee County or those who had visited the Flint area in 2 weeks prior to their illness onset date.

Suspected LD – meets the CDC clinical and laboratory case definition for suspected LD and illness occurred since June 1, 2014 in residents of Genesee County or those who had visited the Flint area in 2 weeks prior to their illness onset date.

Data Sources

1. Legionellosis Case Report Form in Michigan Disease Surveillance System (MDSS)
2. Medical record review from:
 - a. Hospital A; Flint, MI
 - b. Hospital B; Flint, MI
 - c. Hospital C; Grand Blanc, MI
3. Patient interview using Genesee County-specific Legionellosis Questionnaire

Epidemiology

Number of lab-confirmed cases of Legionnaires' disease: 45

Geographic distribution:

44/45 Genesee County (27 Flint)

1/45 Saginaw County

Age range: 26-94 years

Average age (median): 62.1 years (63 years)

% Males: 51% (23/45)

Range of illness onset dates (n=45): 6/6/14- 3/9/2015

Number (%) of deaths*: 11.1% (5/45)

*Edited on 1/15/16: Death was defined as one that occurred during hospitalization, within 30 days of hospital discharge¹ or when *Legionella* was listed as a cause of death on the death certificate.

¹ Mykietiuk A et al. Clin Infect Dis. 2005 Mar 15;40(6):794-9.

Number of cases interviewed: 29 completed + one partial (63% complete; 95.7% in total attempted/completed)

Number (%) of cases hospitalized: 45/45 (100%). Number in ICU: 22/45 (48.8%)

Number (%) of cases who had been hospitalized in 2-weeks prior to onset: 19/45 (37.8%)

Number (%) of cases with ≥ 1 co-morbidity: 25/29 interviewed (86%)

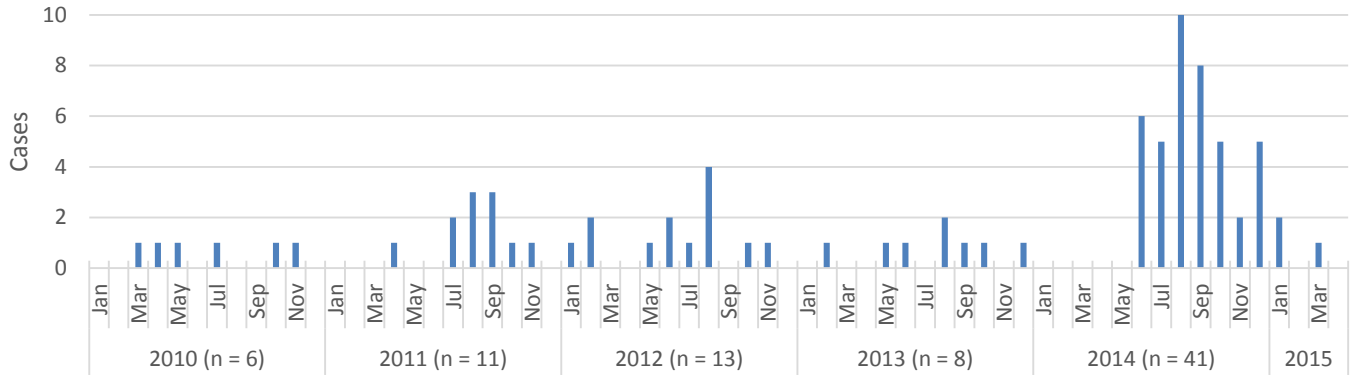
Number (%) of cases who are current or former smokers: 24/29 interviewed (83%)



Epi Curves

Five-year History

Legionellosis Cases by Illness Onset or Referral Date — Genesee County, March 2010–March 2015

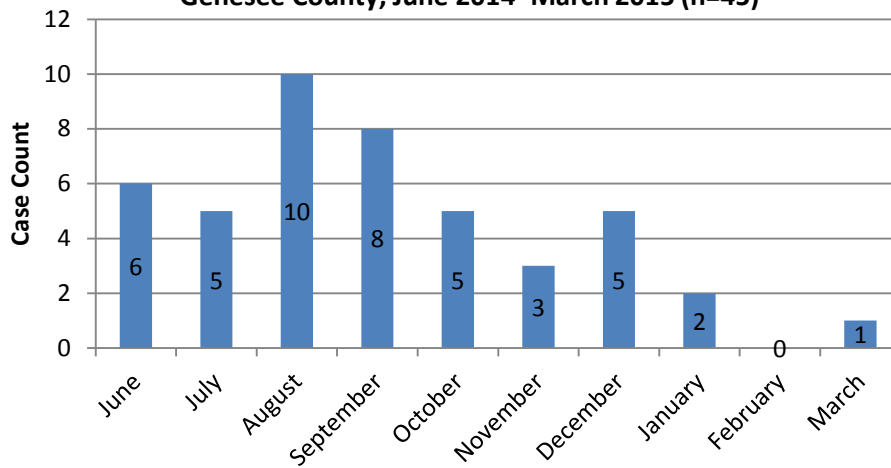


In cases where an accurate onset date was unavailable, referral date was used.

Cases Analyzed in Current Report

This report summarizes data collected from the 45 confirmed legionellosis cases that occurred June 1, 2014 through March 31, 2015. It includes one Saginaw County resident who visited the Flint area within two weeks prior to their illness onset date.

Legionellosis Cases by Estimated Symptom Onset Date — Genesee County, June 2014–March 2015 (n=45)



The graph was edited on 1/15/16 with an updated illness onset date.



Cases by Residence Water Source

Residence water source refers to the source of tap water at patient's home residence during the 14 days before symptom onset and was determined by patient interview and verified by City of Flint water distribution map.

Water Source at Residence	Total N=45	
	n	%
City of Flint water	21	47
City of Flint Township water	3	7
Other municipal water system	4	9
Private well	7	16
Unknown	10	22

Healthcare Exposure

A person was defined as having a healthcare exposure if they visited a hospital or clinic in Flint, Michigan as an inpatient, outpatient, or visitor during the 14 days prior to their symptom onset date.

Healthcare Exposure by Residence Water Source

	Total N=45		Healthcare exposure N=27		No known healthcare exposure N=18	
	n	%	n	%	n	%
City of Flint Water	21	47	13	48	8	44
Other water at residence	24	53	14	52	10	56



Hospitalized Cases By Length of Stay and Residence Water Source

Location	Length of Stay*		
	N	Median (days)	Range
Hospital A	16	2	0.5–14
City of Flint water at patient residence	7	2	0.5–7
Other water at patient residence	9	5	1–14
Hospital B	2	1.5	1–2
City of Flint water at patient residence	1	1	
Other water at patient residence	1	2	
Hospital A and Hospital B; Residence on Flint water	1	5	
Hospital A		3	
Hospital B		2	
Total	19	3	0.5–14

* Length of stay = Number of days hospitalized during 14 days prior to symptom onset date.



Legionellosis Questionnaire Results

Water Changes at Residence

Question Prompts:

Q4. During the last year, has the water pressure at your residence changed?

Q5. During the last year, has the water quality (appearance, taste, smell) at your residence changed?

Q6. Prior to your illness, did you make any recent plumbing changes or repairs at your residence?

Q7. Prior to your illness, were there any water main breaks or other water line issues that affected the water at your residence, including boil water advisories?

	Flint Water at Residence (N=13)		Other Water Source at Residence (N=17)		Total (N=30)	
	n	%	n	%	n	%
Q4. Noticed changes in water pressure	2	15	1	6	3	10
Q5. Noticed changes in water quality	10	77	0	0	10	33
Q6. Made recent plumbing changes or repairs at residence	1	8	2	12	3	10
Q7. Experienced water main breaks or water line issues that affected residence	6	46	0	0	6	20



Work and Travel

Question Prompts:

- Q8. During this 2 week period (exposure period), did you work or volunteer, either full or part time?
- Q10. Visit, reside, or work in a long term care facility, nursing home, assisted living facility, or senior living facility?
- Q11. In the 2 weeks before you before you got sick, did you spend any nights away from home (excluding healthcare settings)?

	Total N=30	
	n	%
Q8. Work outside of the home	5	17
Contractor/painter		
Construction		
HR technician		
Industrial painter		
Welder		
Q8. Volunteer outside of the home	0	0
Q10. Reside or visit an assisted living facility or rehab facility	3*	10
Q11. Spend nights away from home	2**	7

* Patients visited three different locations; none on City of Flint Water

**Patients stayed in two different hotels outside of Flint and stayed ≤2 nights each.



Community Exposures

Question prompt:

Q12. In the 2 weeks before you before you got sick (_____ to _____), did you visit any of the following community venues?

	Total N = 29*	
	n	%
Hotel but did not stay overnight	0	0
Auditorium	1	3
Barbershop or Hair Salon	7	24
Car Wash	5	17
Casino	3	10
Place of Worship	8	28
Gym or Work-out Facility	1	4
Grocery	20	69
Home Improvement Store	7	24
Spa or Nail Salon	0	0
Mall or Department Store	2	7
Movie Theater	0	0

* Number decreased compared to previous tables because of the one partial interview.



Water Exposures in the Home

Question prompt:

Q13. In the 2 weeks before you got sick (___ / ___ / ___ to ___ / ___ / ___), did you have exposure to any of the following water sources, either **at home** or while **away from home**?

	Total N = 29	
	n	%
Shower	27	93
Use a detachable shower head or hose	8	28
Hot tub, whirlpool spa, Jacuzzi tub	2	7
Sat NEAR hot tub or whirlpool spa	0	0
Steam room or wet sauna	0	0
Humidifier	8	28
Respiratory therapy machine	6	21

Water Exposures Outside of the Home

	Total N = 29	
	n	%
Use a detachable shower head or hose	1	3
Hot tub, whirlpool spa, Jacuzzi tub	0	0
Sat NEAR hot tub or whirlpool spa	0	0
Humidifier	1	3
Pool/splash pad/waterpark	3	10
Recreational or cooling misters	0	0
Steam room or wet sauna	0	0
Decorative fountain	1	3
Outdoor watering hose or sprinkler	5	17
Beach, lake, pond, river, creek	2	7



Patient or Proxy reported Comorbidities

	Total N = 29	
	n	%
≥1 comorbidity	25	86
Chronic kidney disease	11	38
Immunocompromised	9	31
Diabetes	12	41
Chronic lung disease	12	41
Asthma or chronic bronchitis	7	24
Heart disease or congestive heart failure	12	41
Liver disease	0	0

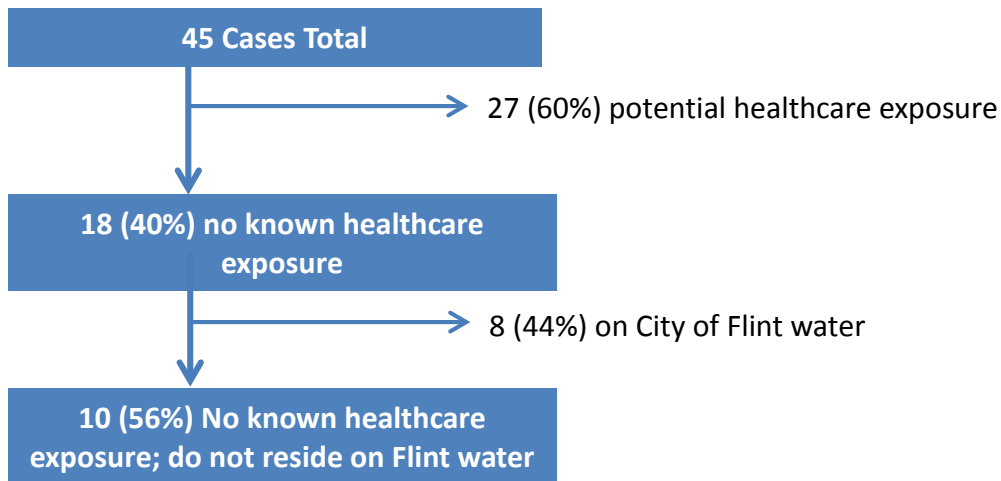
Patient or Proxy reported Health Behaviors

	Total N=29
Former or current smoker, n (%)	24 (83)
Median packs per day (range)	1 (0.14–3.5)
Median years (range)	30 (15–48)
Drinks alcohol, n (%)	9 (31)
Median drinks per day (range)	1 (0.1–2)
Median years (range)	45 (1–57)



Cases with No Known Healthcare Exposure and Residence not on Flint Water Supply

Case Flow-chart



Epi Curve

