

TO: Illinois Department of Public Health, Springfield, Illinois

FROM: Centers for Disease Control and Prevention, Atlanta, Georgia
National Center for Immunization and Respiratory Diseases
Jessica Smith, MPH, Epidemiologist, RDB, DBD
Brian Raphael, PhD, Research Microbiologist, RDB, DBD
Katherine Fay, MD, Epidemic Intelligence Service Officer, RDB, DBD
Laura Cooley, MD, MPHTM, Medical Epidemiologist, RDB, DBD
National Center for Environmental Health
Jasen Kunz, MPH, Environmental Health Specialist, EHSB, DEEHS

DATE: May 25, 2018

REF: Illinois Veterans Home *Legionella* Investigation — Quincy, Illinois, 2018

INTRODUCTION

The Illinois Veterans Home in Quincy, Illinois (IVHQ) was the site of a large legionellosis outbreak in 2015; since that time, cases of Legionnaires' disease have continued to occur at IVHQ despite aggressive, proactive water management. Details of CDC's investigations at IVHQ conducted in August 2015, August 2016, and December 2017 at the request of the Illinois Department of Public Health (IDPH) can be found in previous trip reports.¹⁻³ A general description of *Legionella* ecology and epidemiology can be found in Appendix A of the 2017 trip report.³

On February 12, 2018, IDPH staff notified CDC of two confirmed cases of Legionnaires' disease among residents of the same building at IVHQ and requested on-site technical assistance. A team including an epidemiologist, a microbiologist, and an Epidemic Intelligence Service Officer deployed to Quincy on February 14, 2018. The objectives of the investigation were to:

- Review detailed clinical and exposure histories of all Legionnaires' disease cases associated with IVHQ in 2018
- Review current procedures for pneumonia and Legionnaires' disease surveillance and clinical testing at IVHQ and Blessing Hospital
- Review water management program documents and records at IVHQ since the December 2017 visit to evaluate whether the program could be adjusted further to reduce risk for *Legionella* growth and transmission
- Conduct an environmental assessment and sampling for *Legionella* in buildings at IVHQ where 2018 case-patients resided

¹ CDC. Undetermined source of a healthcare-associated outbreak of Legionnaire's disease — Illinois, 2015. Available at: <http://www.dph.illinois.gov/sites/default/files/publications/cdc-trip-reportquincyl12.31.15.pdf>

² CDC. Healthcare-associated outbreak of Legionnaires' disease among veterans—Quincy, Illinois, 2016. Available at: <http://www.dph.illinois.gov/sites/default/files/publications/cdc-trip-reportquincyl06.26.17.pdf>

³ CDC. Illinois Veterans Home *Legionella* Investigation — Quincy, Illinois, 2017. Available at: <http://dph.illinois.gov/sites/default/files/publications/cdc-trip-reportquincyl1.4.18.pdf>

METHODS

This report addresses the observations and findings from the on-site investigation conducted on February 15 and 16, 2018.

Descriptive epidemiology and disease surveillance

As a result of the ongoing active disease surveillance and case finding measures in place, IVHQ, Adams County Health Department (ACHD), and IDPH were able to diagnose and confirm cases of Legionnaires' disease. With epidemiology staff from IDPH and ACHD and clinical staff from IVHQ, the CDC team reviewed the medical history, clinical course, and possible exposures to water both on and off the IVHQ campus in the 10 days before onset of symptoms for each reported Legionnaires' disease case-patient associated with the facility in 2018. Clinical staff at IVHQ and Blessing Hospital were interviewed to understand current practices related to pneumonia surveillance and clinical testing for Legionnaires' disease. Blessing Hospital clinical, infection prevention, laboratory, and hospital administration staff were interviewed regarding procedures for evaluating and testing for Legionnaires' disease, particularly among residents of IVHQ hospitalized for pneumonia or who received a diagnosis of pneumonia following admission.

Per IDPH staff, incidence of respiratory illness among residents of IVHQ increased above baseline in February 2018. On February 15, CDC convened the first of several calls with CDC's URDO (Unexplained Respiratory Disease Outbreak⁴) team, to facilitate uptake of appropriate testing, treatment, and infection control protocols for other possible respiratory etiologies, in addition to Legionnaires' disease. The multidisciplinary URDO team — consisting of epidemiologists and laboratorians representing other bacterial respiratory diseases, viral respiratory diseases (including influenza among others), and healthcare-associated infections — coordinated the performance of additional diagnostic testing (i.e., TaqMan Array Card [TAC] testing on oro- and nasopharyngeal swabs for the simultaneous detection of multiple respiratory pathogens via PCR). The oro-/nasopharyngeal swab specimens were sent to the CDC laboratory for processing.

Water management program review

With IDPH environmental health staff, the CDC team interviewed IVHQ staff and reviewed documents and records to assess the performance of the water management program in the intervening time between the December 2017 and February 2018 site visits. The CDC team's review focused on buildings associated with case-patient exposures and included:

- Modifications to flushing practices
- Disinfectant and temperature level measurements
- Environmental sampling for *Legionella* conducted by IVHQ's consultant
- Contingency responses performed following identification of cases and/or environmental cultures positive for *Legionella*

⁴ CDC. Unexplained Respiratory Disease Outbreak (URDO). Available at: <https://www.cdc.gov/urdo/index.html>

Environmental assessment and sampling

With IVHQ staff, the CDC team conducted a walkthrough of buildings associated with case-patient exposures in 2018. Sampling sites were selected based upon prior sampling results, epidemiologic information, and observations made during the walkthrough.

Sampling for *Legionella* was undertaken per previously published protocols.⁵ At each sample location, water parameters (i.e., temperature, free chlorine, total chlorine) were measured to characterize the potential risk for *Legionella* amplification. One-liter bulk water samples were collected from showers and sink faucets used by patients identified to date in 2018, as well as the most recent case-patient in 2017 who had exposure to the same building. Showerhead point-of-use filters were removed before both bulk water and swab sampling to allow access to the piping interior. Biofilm samples from sink faucets and showerheads were collected with Dacron-tipped sterile swabs. Sodium thiosulfate was added to each bulk water and swab sample to neutralize the disinfectant. Bulk water samples and swabs were maintained in insulated coolers and sent to CDC's *Legionella* laboratory within 48 hours of sample collection.

The cooling towers that serve the IVHQ campus were shut down for the season on October 17, 2017 according to IVHQ staff. Neither environmental assessment nor sampling were performed on the cooling towers during the site visit.

Laboratory methods

Environmental samples were cultured for *Legionella* at CDC according to previously described methods.⁶ Samples were processed within 48 hours of collection and inoculated on buffered charcoal yeast extract (BCYE) plates either without antibiotic selection or containing PVC and GPVC ([P] = polymyxin B (1000 U/L), [V] = vancomycin (5mg/mL), [C] = cyclohexamide (80 mg/mL), [G] = glycine (2 g/L)). Isolates displaying growth only when supplemented with cysteine were tested using a multiplex *Legionella* PCR assay, which detects *Legionella* species, *L. pneumophila*, and *L. pneumophila* serogroup 1. Genomic DNA from *L. pneumophila* isolates was extracted and sequenced using the Illumina MiSeq instrument. Genome sequences were analyzed using whole genome MLST (wgMLST)⁷ and traditional sequence-based typing (SBT) alleles^{8,9} were extracted *in silico*.

⁵ CDC. Sampling Procedure and Potential Sampling Sites. Available at:

<https://www.cdc.gov/legionella/downloads/cdc-sampling-procedure.pdf>

⁶ Kozak NA, et al. Identification of *Legionella* in the environment. *Methods Mol Bio.* 2013;954:3–25.

⁷ Raphael BH, et al. Genomic resolution of outbreak-associated *Legionella pneumophila* serogroup 1 isolates from New York State. *Appl Environ Microbiol.* 2016;82(12):3582–90.

⁸ Gaia V, et al. Consensus sequence-based scheme for epidemiological typing of clinical and environmental isolates of *Legionella pneumophila*. *J Clin Microbiol.* 2005;43(5):2047–52.

⁹ The European Working Group for *Legionella* Infections. *Legionella* SBT Quality Assessment. Available at:

http://www.hpa-bioinformatics.org.uk/cgi-bin/legionella/sbt/seq_assemble_legionella1.cgi

Lower respiratory tract specimens (e.g., sputum) were plated as described above and incubated for up to 14 days. DNA was also extracted directly from clinical respiratory specimens and examined by multiplex PCR. Where feasible, extracted DNA was also examined via a nested SBT method in which amplified alleles are subjected to Sanger sequencing to determine a Sequence Type of *Legionella* DNA present within the specimen.¹⁰ With this method, DNA associated with the seven SBT loci is amplified directly from the specimen and sequenced, which is especially useful when an isolate cannot be recovered.

Urine specimens sent to CDC were tested via the Binx *Legionella* urinary antigen enzyme immunoassay (EIA).

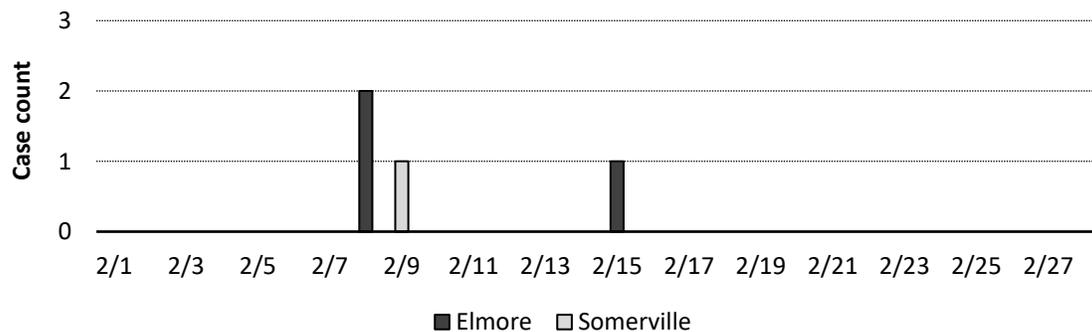
RESULTS

Descriptive epidemiology and disease surveillance

Descriptive epidemiology

A total of four confirmed cases of Legionnaires' disease with possible exposures to IVHQ were identified in 2018, all among residents of the facility. According to case investigations conducted by ACHD in collaboration with IDPH and IVHQ clinical staff, symptom onsets among case-patients ranged from February 8 to 15, 2018. **Figure 1** illustrates the epi curve of resident case-patients per building with symptom onsets in February 2018.

Figure 1. Epi curve of confirmed Legionnaires' disease cases associated with IVHQ by building of residence — February 2018



Among cases identified in 2018, all patients were male with a median age of 84 years (**Table 1**). All four case-patients had a chronic lung disease or other condition present at the time of illness onset, which increases risk for developing Legionnaires' disease. Two patients were hospitalized; no deaths were reported.

¹⁰ Protocol available at: http://www.hpa-bioinformatics.org.uk/legionella/legionella_sbt/php/sbt_homepage.php

Table 1. Selected characteristics and outcomes of Legionnaires' disease case-patients associated with IVHQ — January 1 to February 16, 2018

	N (%)
Total cases	4 (100)
Characteristic	
Median age	84
Male	4 (100)
Current/former smoker	1 (25)
Chronic lung disease*	4 (100)
Immunocompromised†	2 (50)
Difficulty swallowing	1 (25)
Outcome	
Hospitalization	2 (50)
Death	0 (0)

*Includes chronic obstructive pulmonary disease (COPD) and emphysema

†Includes cancer, diabetes, kidney failure, and medications that suppress the immune system

Three case-patients resided in the Elmore building during their exposure periods (**Table 2**); the other case-patient resided in the Somerville building but visited Elmore on at least one occasion during his exposure period. The case-patient who resided in Somerville reportedly slept with his head in close proximity to the in-room sink. Two case-patients reported leaving the IVHQ campus during their respective exposure periods.

Table 2. Selected possible exposure locations per Legionnaires' disease case-patient associated with IVHQ — January 1 to February 16, 2018

Case	Date of symptom onset	Date of laboratory confirmation	Building of residence	Respiratory therapy equipment	Bedroom with in-room sink	Tub	Shower*	Off campus
1	2/8/18	2/12/18	Elmore	No	Yes	No	Yes	No
2	2/8/18	2/12/18	Elmore	Yes	Yes	No	Yes	No
3	2/9/18	2/14/18	Somerville	Yes	Yes	No	Yes	Yes
4	2/15/18	2/16/18	Elmore	No	Yes	No	Yes	Yes

*The showers used by the four patients had point-of-use filters installed

Disease surveillance

The CDC team observed several enhancements to IVHQ's pneumonia surveillance and testing protocols implemented since the December 2017 site visit. In response to the prior investigations at IVHQ, IDPH and IVHQ staff established a system for reviewing healthcare-

associated pneumonia surveillance among IVHQ residents on a weekly basis. This improved coordination between clinical and public health staff facilitated timely collection of appropriate specimens for *Legionella* testing, including sputum, among patients with possible exposures to IVHQ and suspected clinical or radiographic pneumonia. Furthermore, both Blessing Hospital and the IDPH state laboratory implemented UAT via BinaxNOW in early February 2018. In-house testing at the local hospital enables more rapid diagnosis of Legionnaires' disease compared to sending specimens out to a reference laboratory. However, as this capacity was newly implemented at the time of the site visit, Blessing Hospital continued sending specimens to a reference laboratory per usual procedure for concurrent testing via Binax EIA.

All case-patients were initially diagnosed via UAT (**Table 3**). The results of testing on split specimens were discordant between Blessing Hospital (BinaxNOW) and the reference laboratory (Binax EIA) for the first two cases identified. In order to further confirm the diagnoses, remaining urine from these case-patients was also sent to CDC for UAT via Binax EIA. Sputa obtained from cases 3 and 4 were cultured and subjected to direct PCR testing at CDC. No isolates were recovered from either specimen, however, case 4's sputum was PCR-positive for *L. pneumophila* serogroup 1. A case was considered laboratory-confirmed if culture of a lower respiratory specimen was positive for *Legionella* spp. or when UAT was positive. In the event of discrepant results between UAT formats, a positive Binax EIA result was considered confirmatory given a small difference in the sensitivity of the EIA assay (97.7%) compared to the BinaxNOW assay (95%).^{11,12} Note, the clinical significance of minor sensitivity differences between BinaxNOW and Binax EIA during this particular investigation was not anticipated based on past performance of both testing platforms in other clinical scenarios. Although preliminary testing at CDC indicated that the antigens prepared from the outbreak strain reacted with both assays *in vitro*, the underlying reason for the case-patient urine specimen discrepancies remains unclear.

Table 3. Legionnaires' disease diagnostic testing results for case-patients associated with IVHQ — January 1 to February 16, 2018

Case	Specimen type	Day of collection*	Blessing Hospital BinaxNOW	Reference laboratory Binax EIA	CDC Binax EIA	CDC sputum culture	CDC sputum PCR
1	urine	0	Negative	Positive	Positive	-	-
2	urine	2	Negative	Positive	Positive	-	-
3	urine	1	NT	Positive	NT	-	-
	urine	5	Positive	NT	NT	-	-
4	sputum	7	-	-	-	Negative	Negative
	urine	0	Positive	NT	Positive	-	-
	sputum	2	-	-	-	Negative	Positive

* Number of days after symptom onset; EIA = enzyme immunoassay, NT = not tested

¹¹ <https://ensur.invmed.com/ensur/broker/ensurbroker.aspx?code=CLSI-0004&cs=27409767>

¹² <https://ensur.invmed.com/ensur/broker/ensurbroker.aspx?code=IN851050&cs=26726359>

During this time, a congruent increase in respiratory illness was observed. On February 14, CDC learned that 15 IVHQ residents (including the cases of Legionnaires' disease described above) had been evaluated for new onset of respiratory illness, which is above the baseline for respiratory illnesses at IVHQ per IDPH staff. By February 20, the number of residents with respiratory illness had increased to 30. Among those 30 patients, 17 received testing via TAC at CDC. Pathogens identified by TAC included (not mutually exclusive): respiratory syncytial virus (N=8), *Staphylococcus aureus* (N=7), *Streptococcus pneumoniae* (N=4), human coronavirus HKU1 (N=3), *Haemophilus influenzae* (N=2), influenza A (N=1), influenza B (N=1), and human coronavirus OC43 (N=1). Of the two cases of Legionnaires' disease who also had oro- and nasopharyngeal swabs collected for testing via TAC (cases 3 and 4), no other pathogens were identified. In consultation with IDPH staff, IVHQ and Blessing Hospital clinical staff were referred to CDC partners for further guidance on appropriate control measures for other potential pathogens identified.

Water management program review

Overall findings from the review of the water management program, environmental sampling results from IVHQ's *Legionella* consultant, and interviews with IDPH and IVHQ staff were consistent with the January 2018 report, with the following updates:

- Flushing protocols were modified to reduce the duration of twice-daily flushing events (daily and nightly). Note that in 2017, the CDC team suggested (as described in the January 4, 2018 report¹³) that IVHQ may need to adjust frequency, location, and/or duration of hot water flushing to ensure that thermal control limits are maintained within the hot water system and to ensure that exposure to *Legionella*-containing aerosols is minimized.
- According to IDPH staff interviews, instances were observed where residents were not moved from their respective rooms while flushing was being performed. Flushing while residents are located in their rooms may pose a risk of exposure to *Legionella*-containing aerosols, particularly when performed where the heads of residents' beds are in close proximity to their sink faucets.
- Disinfectant and temperature data did not reveal any trends suggesting increased potential for *Legionella* amplification.
- As with prior rounds of testing, periodic positive detections for *Legionella* via culture continued to occur in buildings associated with recent cases. According to interviews and water management program documentation, IVHQ staff took appropriate measures and implemented contingency responses when *Legionella* was detected.

¹³ CDC. Illinois Veterans Home *Legionella* Investigation — Quincy, Illinois, 2017. Available at: <http://dph.illinois.gov/sites/default/files/publications/cdc-trip-reportquincyl1.4.18.pdf>

Environmental assessment

The CDC team conducted targeted environmental assessments of the Elmore and Somerville buildings. The locations of *Legionella* environmental sampling and corresponding water parameter measurements are listed in **Appendix A**. Isolated hot water (hot water that has not been blended with cold to prevent scalding) temperatures ranged from 130.4–153.1°F (median: 143.8°F). As occurred during the 2017 visit, the water heater in the Elmore basement was not sampled by the CDC team because it was inaccessible; however, the thermostat set point was observed to be >140°F. The hot water return in the Elmore building was measured at 140.8°F. Cold water temperatures ranged from 47.7–64.8°F (median: 48.8°F).

Free chlorine ranged from 0.1–3.5 mg/L (median: 1.2 mg/L); total chlorine ranged from 0.1–3.5 mg/L (median: 1.3 mg/L). Disinfectant targets, as specified by IVHQ's water management program for both hot and cold water distribution and measured daily at sinks and showers, are 0.2–4.0 mg/L for free chlorine and 0.5–2.0 mg/L for total chlorine.

Environmental *Legionella* culture results and comparison to clinical results

L. pneumophila was recovered from one of 22 environmental samples collected (**Appendix A**). This positive swab sample was obtained from a showerhead that normally contains a 0.2 micron point-of-use filter. The filter was removed to obtain bulk water and swab samples. A bulk water sample obtained after the filter was put back in place was negative, demonstrating the effectiveness of the filter to remove *Legionella* from the potable water.

This isolate belonged to serogroup 1 and genome sequencing revealed that it was ST36 — the same type associated with the 2015 outbreak at IVHQ and recovered in subsequent environmental sampling at the facility in 2016 and 2017. ST36 is among the most common sequence types associated with sporadic clinical isolates and in outbreaks investigated by CDC.¹⁴ Further analysis using wgMLST revealed that the 2018 environmental isolate obtained shared >99% identical alleles with previous clinical and environmental isolates (**Appendix B**). The lack of a clinical isolate from cases 3 and 4 precludes higher resolution analysis using wgMLST; however, *Legionella* DNA present in the lower respiratory specimen from case 4 was revealed to be ST36 via the nested SBT method.

CONCLUSIONS AND RECOMMENDATIONS

Additional Legionnaires' disease cases and persistence of the same strain of *Legionella* despite aggressive water management indicate that risk for transmission continues within IVHQ building water systems. The CDC team's overall conclusions remain similar to those described in the January 2018 report, with the following updates:

- Recommendations for clinical testing and coordination between IVHQ, Blessing Hospital, and public health had been implemented.

¹⁴ Kozak-Muiznieks NA, et al. Prevalence of sequence types among clinical and environmental isolates of *Legionella pneumophila* serogroup 1 in the United States from 1982 to 2012. *J Clin Microbiol.* 2014;52(1):201–11.

- Differences in sensitivity between different formats of UAT (BinaxNOW versus Binax EIA) were identified.
- While the duration of flushing fixtures was decreased according to staff interviews, the recommendation to ensure residents are not in the room while flushing takes place had not been consistently implemented.

Regarding the interpretation of TAC results, detection of a respiratory pathogen does not necessarily indicate the cause of illness; isolation of some pathogens via TAC may represent colonization of the upper respiratory tract. However, in this setting, the increased number of residents with respiratory symptoms in February 2018 is likely due to concomitant respiratory infection (likely due to a combination of viruses such as RSV, human coronavirus, and influenza). These findings highlight the importance of continuing to implement basic infection control measures to prevent transmission of respiratory pathogens in a facility housing a vulnerable population, particularly during times of expected seasonal peaks.

CDC recommendations provided as part of the 2015 and 2016 Epi-Aid investigations and 2017 site visit should be reviewed and considered still applicable. The additional recommendations below were developed in response to the four new cases identified in 2018 and observations made during the February 2018 site visit.

To immediately reduce the risk of *Legionella* transmission to other IVHQ residents, staff and visitors:

- IVHQ should immediately implement water restrictions and/or place POU filters on all fixtures until further notice from IDPH (**Appendix C**).
- If POU filters are installed, ensure they are in place and functioning as designed prior to consideration of lifting water restrictions.
- IVHQ should ensure residents are not in the room when flushing of fixtures is performed.

Longer-term recommendations include:

Disease surveillance

- IVHQ and Blessing Hospital should continue active clinical surveillance and appropriate clinical testing for Legionnaires' disease.
- Blessing Hospital should continue testing urine specimens using the rapid BinaxNOW assay.
- IDPH should continue to ensure that clusters of Legionnaires' disease are detected rapidly. Given sensitivity differences between the *Legionella* EIA and BinaxNOW testing formats, IDPH should continue to facilitate direction of urine specimens that are negative via BinaxNOW at Blessing Hospital to a laboratory that offers EIA testing with a turnaround time of 48 hours or less, including shipping and transport time.

- IVHQ and Blessing Hospital should continue obtaining lower respiratory specimens for *Legionella*-specific culture.

Water management program

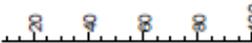
- The presence of POU filters may change water quality parameters and performance of the water management program (e.g., reduced water flow, increased water age, reduced residual disinfectant, and the development of biofilms); as such, the program should be continually reevaluated any time modifications are made. Because POU filters may eventually be removed — because either the underlying issues contributing to *Legionella* growth have been addressed, or residents or staff remove them prematurely due to clogging or other reasons — it is important to maintain water quality behind POU filters. This will require the engagement of a *Legionella* consultant to continue to optimize the program and manage unintended consequences.
- IVHQ should develop a protocol to ensure that clogged filters or filters with reduced flow are rapidly identified and replaced as needed to minimize the risk of exposure to residents, staff, and visitors; these activities should be documented as part of the water management program.
- IVHQ should continue to work with a *Legionella* consultant to determine optimal flushing strategy for minimizing *Legionella* growth and transmission.

Despite the considerable time, effort, and resources committed to achieving an optimal water management program at IVHQ, there continues to be *Legionella* growth and cases of Legionnaires' disease associated with the Elmore and Somerville buildings, likely attributable to plumbing age and materials and resident population characteristics. Due to the presence of biofilm, corrosion, and buildup of scale and sediment, these buildings will likely remain at increased risk for *Legionella* growth within the plumbing system and transmission to residents, staff, and visitors. While POU filters are an effective temporizing measure that can reduce risk in the near term, they do not address the underlying conditions leading to *Legionella* growth and may not be feasible to maintain indefinitely. As the root cause(s) of *Legionella* growth and transmission associated with these particular building water systems continue(s) to be unclear, engineering controls, building water system modifications, and/or closure of specific buildings may be considered in an effort to prevent additional cases. If relocation of residents to another building or facility is among the options considered, the possibility of adverse outcomes associated with relocation of older individuals should be evaluated in consultation with someone who has expertise in geriatric medicine. Residents and their families should be included in decisions about relocation. Please note that the advanced age and underlying medical conditions common among IVHQ residents means they are highly susceptible to Legionnaires' disease, and that some disease risk will remain irrespective of location. Wherever susceptible populations reside, effective water management is paramount.

APPENDIX A. ENVIRONMENTAL SAMPLE LOCATIONS, WATER PARAMETERS, AND *LEGIONELLA* CULTURE RESULTS — IVHQ, 2018

CDC sample ID	Collection date	Sample type	Sample description	Temp (°F)	Free Cl ₂ (mg/L)	Total Cl ₂ (mg/L)	<i>Legionella</i> culture results
IL18-1-001	2/15/2018	water	Elmore 106 sink, cold	47.3	0.25	0.42	ND
IL18-1-002	2/15/2018	water	Elmore 106 sink, hot (direct)	145.6	0.22	0.12	ND
IL18-1-003	2/15/2018	water	Elmore hot return	140.8	0.1	0.4	ND
IL18-1-004	2/15/2018	water	Elmore laundry room sink, cold	52.4	2.0	2.3	ND
IL18-1-005	2/15/2018	water	Elmore laundry room sink, hot (direct)	130.4	0.1	0.3	ND
IL18-1-006	2/15/2018	water	Elmore 114 shower, mix, pre-filter	102.0	0.25	0.5	ND
IL18-1-007	2/15/2018	water	Elmore 114 shower, mix, post-filter	NA	NA	NA	ND
IL18-1-008	2/15/2018	swab	Elmore 114 shower, hose, pre-filter	NA	NA	NA	<i>L. pneumophila</i> serogroup 1
IL18-1-009	2/15/2018	water	Elmore 122 sink, cold	49.2	>3.5	>3.5	ND
IL18-1-010	2/15/2018	water	Elmore 122 sink, mix	104.8	>3.5	>3.5	ND
IL18-1-011	2/15/2018	water	Elmore 122 sink, hot (direct)	153.1	1.3	1	ND
IL18-1-012	2/15/2018	water	Elmore 212 sink, cold	47.4	3.5	3.5	ND
IL18-1-013	2/15/2018	water	Elmore 212 sink, mix	105.6	2.0	2.2	ND
IL18-1-014	2/15/2018	water	Elmore 226 sink, cold	64.8	>3.5	3.5	ND
IL18-1-015	2/15/2018	water	Elmore 226 sink, mix	104.2	2.0	2.3	ND
IL18-1-016	2/15/2018	swab	Somerville 115 sink, faucet	NA	NA	NA	ND
IL18-1-017	2/15/2018	water	Somerville 115 sink, cold	48.3	3.5	3.5	ND
IL18-1-018	2/15/2018	water	Somerville 115 sink, mix	100.6	0.3	1.3	ND
IL18-1-019	2/15/2018	water	Somerville 115 sink, hot (direct)	143.8	0.1	0.2	ND
IL18-1-020	2/15/2018	swab	Somerville 1st floor men's shower, hose, pre-filter	NA	NA	NA	ND
IL18-1-021	2/15/2018	water	Somerville 1st floor men's shower, mix, pre-filter	101.9	1.0	1.2	ND
IL18-1-022	2/15/2018	water	Somerville 1st floor men's shower, mix, post-filter	NA	NA	NA	ND

APPENDIX B. *LEGIONELLA PNEUMOPHILA* WHOLE GENOME MLST (wgMLST) FROM ISOLATES ASSOCIATED WITH IVHQ, 2015–2018



Year	Sample_ID	Serogroup	Source	ST	State	Comments
2015	D7594	1	Clinical	36	IL	Lung tissue (patient A)
2015	D7599	1	Clinical	36	IL	Lung tissue (patient B)
2016	F4612	1	Environmental	36	IL	Smith sink (Phigenics)
2016	F4605	1	Environmental	36	IL	Sommerville 203 sink (Phigenics)
2016	F4607	1	Environmental	36	IL	Fletcher 1-7 (Phigenics)
2017	F4819	1	Environmental	36	IL	Elmore 2nd floor shower, pre-filter
2018	F4826	1	Environmental	36	IL	Elmore 114 shower, pre-filter
2016	F4613	1	Environmental	36	IL	Schapers tub (Phigenics)
2015	F4529	1	Environmental	36	IL	Schapers 104 sink
2017	F4820	1	Environmental	36	IL	Elmore 2nd floor shower, pre-filter
2015	F4516	1	Environmental	36	IL	Cooling tower
2016	F4615	1	Environmental	36	IL	Sommerville 203 sink
2017	F4821	1	Environmental	36	IL	Elmore 2nd floor shower, pre-filter
2015	F4508	1	Environmental	1	IL	Cooling tower

APPENDIX C. CDC LETTER TO ILLINOIS DEPARTMENT OF VETERANS' AFFAIRS



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
and Prevention (CDC)
Atlanta GA 30333

Erica Jeffries
Director, Illinois Department of Veterans' Affairs
69 West Washington Street
Suite 1620
Chicago, Illinois 60602
February 18, 2018

Dear Director Jeffries:

We applaud your ongoing efforts to reduce the risk of *Legionella* growth and transmission at the Illinois Veterans' Home at Quincy (IVHQ). The report of 4 additional IVHQ residents in February with respiratory symptoms and positive clinical testing for *Legionella* both surprises and concerns us. It seems unusual that there would be new cases of Legionnaires' disease at a facility where such aggressive intervention has been undertaken to reduce the risk of *Legionella* growth and transmission. Furthermore, as you know, reported cases of Legionnaires' disease generally demonstrate seasonality, with more cases being diagnosed in warmer months. Four cases in February is notable from the epidemiologic viewpoint. We agree with you that immediate, temporizing interventions are needed to reduce the risk of transmission of *Legionella* to susceptible people while the investigation is underway.

Based on your request to provide criteria for when water restrictions can be lifted during the course of this Legionnaires' disease outbreak investigation, we have compiled the following information regarding water restrictions specifically at IVHQ:

- Showers have already been fitted with 0.2 micron point-of-use filters, and thus can continue to be used where filters are present and functioning as designed.
- Short of installation of 0.2 micron point-of-use filters on all fixtures, water restrictions should be continued as specified by the Illinois Department of Public Health (IDPH), to include restrictions on the sink faucets in the patients' rooms campus-wide, meaning residents should not use these faucets for drinking, washing hands, or brushing teeth. Bottled water should be used instead. Sinks that are fitted with 0.2 micron point-of-use filters that are functioning as designed can be used.
- We recommend preventing exposure to unfiltered water from tub faucets. As mentioned in the CDC report dated January 4, 2018¹, IVHQ can consider working with the soaking tub manufacturer to identify *Legionella* filtration options for water that is delivered to or through the tub filler.
- We also recommend preventing exposure to non-sterile ice from IVHQ ice machines.
- While water restrictions are in place, flushing protocols should be evaluated to ensure that flushing is implemented in a manner that protects residents' health. As mentioned in the January report, it is imperative that IVHQ residents are not in their rooms while flushing activities take place and that staff members who perform flushing limit their own exposure to *Legionella*-containing aerosols.
- Infection control protocols should also be reviewed to ensure that hand hygiene is being maintained via alternate routes (e.g., hand sanitizer).
- Water restrictions can be discontinued under the direction of IDPH when the following

¹ <http://dph.illinois.gov/sites/default/files/publications/cdc-trip-reportquincvil1.4.18.pdf>

conditions have been met:

- Adequate clinical testing has been performed to ensure that all cases of Legionnaires' disease have been identified.
- New cases of Legionnaires' disease are not occurring.
- More is understood regarding possible sources of *Legionella* transmission, based on results of environmental sampling.
- Mitigation strategies have been employed.
- Effectiveness of mitigation strategies has been evaluated through repeat environmental sampling.

A recommendation that water restrictions can be lifted will come from IDPH, not CDC. IDPH may feel comfortable reducing the number of buildings for which water restrictions are recommended once additional clinical and environmental data are available.

Finally, we would like to take this opportunity to emphasize the importance of testing residents of IVHQ who develop pneumonia for Legionnaires' disease with both culture of lower respiratory specimens and UAT, regardless of whether they are treated at IVHQ or at Blessing Hospital.

For reference, we are including more general information regarding our approach to immediate control measures. We recognize that this is a complex and evolving situation; other interventions may be necessary under different circumstances.

If a healthcare facility's potable water (i.e., drinking water) system is thought to be a source of *Legionella* transmission, management should consider implementing water restrictions and/or installing point-of-use filters (either globally or in areas of greatest risk). These steps can reduce the possibility of ongoing transmission to vulnerable patients. Options should be tailored to the structural characteristics of the facility and circumstances of the outbreak. Water restrictions and/or point-of-use filters, if implemented, should continue until the investigation has identified the possible source(s), remediation has been performed, and control measures are believed to have controlled the risk; the timing will vary by outbreak. Examples of immediate control measures include:

- Restricting patients from taking showers (using sponge baths instead); avoiding exposure to therapy pools and spas
- For hematopoietic stem cell or solid-organ transplant patients, using sterile water for tooth brushing, drinking, and flushing [feeding tubes](#); for other vulnerable patients, using bottled water
- Avoiding use of water from faucets in patient rooms to avoid creating aerosols
- Avoiding use of non-sterile ice from facility ice machines for anyone at risk for swallowing difficulties
- Installing 0.2 micron biological point-of-use filters on any showers or faucets intended for use
 - Understand manufacturer's recommendations regarding the temperature, pressure, and chemical loads that filters can withstand and suggested frequency for replacement
 - Filters may need to be removed during acute remediation procedures
- Halting new admissions or temporarily closing the building, affected area, or device
- Ensuring that contingency responses and corrective actions are implemented if the building already has a water management program

- Distributing notification letters to the appropriate audience(s)

Note: In [healthcare settings](#), only sterile (not distilled, nonsterile) water should be used to fill reservoirs of respiratory equipment intended for nebulization under all circumstances (not just during an outbreak).

Water restrictions may lead to areas of stagnation in the water system(s); strategies for safe periodic flushing may be necessary to prevent *Legionella* growth.

Thank you again for your hard work and collaboration. Please let us know if you have any questions.

Sincerely,



CDR Laura Cooley, MD, MPHTM
Respiratory Diseases Branch
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention
1600 Clifton Road NE, MS-C25
Atlanta, GA 30329
LCooley@cdc.gov