

PUBLIC HEALTH ALERTS | IN PARTNERSHIP WITH CIDRAP

Outbreak of Legionnaires' Disease Associated with Cooling Tower Systems in Central Harlem

Emily McGibbon, M.P.H.,¹ Elizabeth Iuppa Burke, M.P.H.,¹ Elizabeth Watts, Ph.D.,¹ Bri Beaver-Timmons, M.P.H.,¹ Vincent Law, M.P.H.,¹ Yin Ling Leung, M.P.H.,¹ Anupa George, M.P.H.,¹ Lia Qiu, Ph.D.,¹ Stefan Silver, M.S.,¹ Vasudha Reddy, M.P.H.,¹ Enoma Omoregie, Ph.D.,¹ Ulrike Siemetzki-Kapoor, Ph.D.,¹ Diane Fung, P.E., M.P.H.,¹ Corinne Schiff, J.D.,¹ and Shama Desai Ahuja, Ph.D., M.P.H.¹

Abstract

Cooling tower systems have been the source of multiple large Legionnaires' disease outbreaks. We report a July–August 2025 outbreak in the Central Harlem area of New York City, with 118 confirmed cases and seven deaths. An investigation was initiated on the day the daily spatiotemporal cluster detection analysis by the New York City Health Department noted eight positive urine antigen test results for *Legionella pneumophila* serogroup 1. A total of 43 cooling tower systems were sampled by day 3. Whole-genome sequencing analysis suggested that the available clinical isolates were highly related to those from two cooling towers located on the same city block.

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Introduction

The source of a 2015 Legionnaires' disease outbreak in New York City (NYC) in the South Bronx¹ was a cooling tower system, which is a known cause of large Legionnaires' disease outbreaks worldwide.² Subsequently, NYC implemented regulations requiring building owners to register cooling tower systems and to develop maintenance and monitoring programs.^{3,4} This report describes a July–August 2025 NYC outbreak in Central Harlem. Information was collected as part of a routine public health response without Institutional Review Board review.

Investigation and Outcomes

CLUSTER IDENTIFICATION

On Friday, July 25, 2025, the daily spatiotemporal cluster detection analysis by the NYC Health Department using SaTScan software v10.3.2 detected eight reports of positive urine antigen test results for *Legionella pneumophila* serogroup 1 (Lp1); the software indicated a very strong cluster that was unlikely to have occurred by chance.⁵ All patient addresses were in Central Harlem within a 1-km radius. Within hours of signal notification, five of eight reports were confirmed as cases,⁶ prompting a community outbreak investigation.

The author affiliation is listed at the end of the article.

Emily McGibbon can be contacted at ehumeng@health.nyc.gov.

The outbreak zone was defined as a 1-km radius around the mean center of the addresses of the eight initial patients. Outbreak-associated cases were defined as confirmed cases who resided, worked, or stayed in the

outbreak zone from June 30 through August 15. A press release on July 25 encouraged anyone experiencing symptoms in the outbreak-associated zip codes to seek immediate care. The Health Department issued a health

Table 1. Characteristics of Confirmed Legionnaires' Disease Cases in Central Harlem, July–August 2025 (N=118).*

Characteristic	N (or days)	% (or range)
Sex		
Female	56	47.5
Male	62	52.5
Age group		
0–39 y	10	8.5
40–65 y	52	44.1
66–80 y	43	36.4
≥81 y	13	11.0
Race/ethnicity		
Asian	1	0.8
Black	96	81.4
Hispanic/Latino	10	8.5
White	3	2.5
Unknown/missing/declined to answer	8	6.8
Exposure category		
Lived in outbreak zone	105	89.0
Traveled to or worked in outbreak zone	13	11.0
Any chronic health condition known to increase risk for Legionnaires' disease (not mutually exclusive)	70	59.8
Cancer	13	11.1
Chronic lung disease	34	29.1
Diabetes	38	32.5
HIV infection	9	7.7
Immunosuppressive therapy (e.g., chemotherapy, radiation, steroids)	9	7.7
Renal failure/dialysis	3	2.6
Other comorbidities	92	78.6
Smoking		
Current	33	28.0
Former	33	28.0
Never smoked	41	34.8
Unknown/missing	11	9.3
Older than 50	89	76.1
No risk factors for Legionnaire's disease (e.g., age <50, no comorbidities, no smoking history)	9	7.6
Hospitalized	92	78.0
Median length of hospitalization (days)	5	1–39
Required ICU care	24	26.1
Median length of stay in ICU (days)	3	1–19
Positive result on legionella test type (not mutually exclusive)		
Urine antigen test	115	97.5
Polymerase chain reaction test	12	10.2
Culture	8	6.8

*ICU indicates intensive care unit.

advisory on July 28 for clinicians to remain alert for Legionnaires' disease and to conduct diagnostic testing for patients with pneumonia.

DEMOGRAPHIC AND CLINICAL CHARACTERISTICS

Among 129 reports, 118 were confirmed cases of Legionnaires' disease (Table 1). Median patient age was 65 years (range, 32–97 years). Most patients were Black (n=96 [81.4%]). Ninety-two patients (78.0%) were hospitalized, with 24 admitted to an intensive care unit. Seven outbreak-associated deaths occurred; median time from symptom onset to death was 8 days (range, 1–15 days).

Health Department investigators conducted clinician outreach to maximize the number of cultures available for testing. Health care facilities nearest to the outbreak implemented reminders in patient medical record systems for physicians to order legionella cultures. In total, nine clinical cultures for eight patients were positive for *L. pneumophila* and analyzed for sequencing.

ENVIRONMENTAL INVESTIGATION AND TESTING

By July 28, Health Department scientists identified 42 cooling tower systems at 32 buildings in the outbreak zone (including a 0.1-km buffer) from the NYC Cooling Tower Registry and completed water sampling. One unregistered cooling tower system was identified when Health Department staff with knowledge of a new building in the neighborhood flagged that it may have a cooling tower. Follow-up with the construction team confirmed an operating cooling tower, and samples were collected on July 28.

Environmental samples were analyzed for the presence of legionella species using polymerase chain reaction (PCR) to obtain rapid results (24–48 hours), the International Organization for Standardization culture method, and the Legiolert test (IDEXX) to verify the presence of legionella species and obtain Lp1 isolates.⁷ Whole-genome

sequencing was performed on isolates from clinical and environmental samples.

PUBLIC HEALTH RESPONSE

Of the 43 cooling tower systems sampled, eight (including the unregistered tower) were both PCR- and culture-positive for Lp or Lp1 by at least one method; these owners were required to complete a biocide increase followed by full cleaning. The owner of the unregistered system was ordered to register. Three samples were PCR-positive but culture-negative, and four were PCR-negative but culture-positive. Owners of PCR-positive systems increased biocide application by August 1, and owners of culture-positive systems completed full cleaning by August 15.

Based on whole-genome sequencing analysis, two isolates from separate cooling tower systems appeared to be highly related to the eight patients' clinical isolates using both kSNP (version 4.0) and National Center for Biotechnology Information (NCBI) Pathogen Detection pipelines (NCBI SNP cluster code PDS000001800). Additional details are available in the Supplementary Appendix.^{8,9} Both cooling towers were on the same city block, approximately 0.1 km from each other. One tower (Tower A) was the unregistered cooling tower. Table 2 provides details of testing at each tower and biocide and cleaning timelines. The last outbreak case was diagnosed on August 19, with the end of the outbreak announced on August 29.

After identifying the two potential source towers, the Health Department reviewed the records for routine monitoring and legionella testing implemented by the operators before the outbreak. One tower (Tower A) had major lapses in routine monitoring, had no treatment adjustments for out-of-range water quality, and had missed required legionella sampling. The other tower (Tower B) met routine monitoring and sampling requirements, with three intermittent periods in June and July when disinfectant levels were

Table 2. Results and Corrective Actions from Source Cooling Towers A and B.*

Results and Corrective Actions	Tower A	Tower B
Test results		
PCR	Lp1	Legionella species
ISO culture method (CFU/mL)	>3000	No legionella detected
Legiolert (MPN/mL)	522.3	12.4
Biocide increase initiated (date)	July 31	July 30
Full cleaning conducted (date)	August 1	August 7

*CFU indicates colony-forming units; ISO, International Organization for Standardization; Lp1, *Legionella pneumophila* serogroup 1; MPN, most probable number; and PCR, polymerase chain reaction.

below target for two consecutive readings before returning to target after a routine biocide dose.

Preliminary Conclusions and Actions

This outbreak was notable in that two cooling tower systems were genetically linked to outbreak clinical isolates.¹⁰ Retrospective analysis of water quality during the exposure period showed that one of the towers had higher legionella concentrations and worse overall water quality than the other. However, in the absence of defined thresholds on the amount of legionella bacteria required to infect humans and without a clearer understanding of air flow and exposure patterns, we were unable to conclude whether one cooling tower was the source of infection. Of note, the NCBI Pathogen Detection cluster code for this outbreak, PDS000001800, was previously implicated in cooling tower system-associated Legionnaires' disease outbreaks in NYC, including the South Bronx outbreak in 2015 and other outbreaks in 2018, 2021, and 2022.

This investigation shows the utility of a cooling tower registry, which enabled rapid identification and sampling of registered cooling towers in the outbreak zone. The registry also allows the Health Department to instruct owners on best practices to properly maintain a cooling tower and on risks when lapses occur. The unregistered tower had high levels of legionella that went undetected without the active monitoring and testing required by NYC regulations, whereas legionella growth was quickly detected in Tower B when there was a slight and intermittent decline in water quality. Prompt cluster identification and mobilization of the investigation were crucial to ending this outbreak.

Disclosures

Author disclosures are available at evidence.nejm.org.

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Author Affiliation

¹New York City Health Department, Queens, NY, USA

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