Summary and Frequently Asked Questions

What is Legionnaires’ disease?
• Legionnaires’ disease is a form of pneumonia caused by *Legionella* bacteria.
• People can contract Legionnaires’ disease by *inhaling* droplets of warm water (mist) contaminated with *Legionella* bacteria into their lungs.
• People cannot contract Legionnaires’ disease by *drinking* water contaminated with *Legionella* bacteria.
• People generally develop symptoms of Legionnaires’ disease between 2 and 10 days after they inhale *Legionella* bacteria. The time between inhaling *Legionella* bacteria and the development of symptoms is called the disease incubation period.
• *Legionella* bacteria are very common in the natural environment. Most people who are exposed to the bacteria do not develop Legionnaires’ disease.

How common is Legionnaires’ disease in NYC?
• Legionnaires’ disease is not a common disease. Among the 8.5 million people living in New York City (NYC), between 200 and 500 cases of Legionnaires’ disease are reported each year. Legionnaires’ disease patients who are hospitalized therefore account for a small proportion of the approximately 35,000 hospitalizations for pneumonia that occur in New York City each year. In 2017, there were 435 reported cases of Legionnaires’ disease. By comparison, about 23,000 cases of influenza were reported that same year.

Is the rate of Legionnaires’ disease increasing in New York City and across the United States?
• While it remains a relatively rare infection, the rate of Legionnaires’ disease is increasing significantly in NYC. This increase in the disease rate might be driven by: (1) more people who have *Legionella* pneumonia getting diagnosed and reported to the Health Department due increased use of diagnostic testing by health care providers; (2) more people contracting *Legionella* pneumonia; or (3) some combination of these factors. Factors that might increase the number of people contracting *Legionella* pneumonia include an aging population, aging plumbing infrastructure or changing weather patterns.
  - From 2007-2017, there was an 8.1% average increase in the rate of Legionnaires’ disease cases citywide each year.
  - The rate of Legionnaires’ disease increased significantly in all boroughs and demographic groups over this period.
• Data from the Centers for Disease Control and Prevention (CDC) show that rates of Legionnaires’ disease increased across the country from 2010-2017. During that period, 18 states had an average annual percent increase in cases that was larger than the increase in NYC. See Appendix A.

Who gets Legionnaires’ disease?
• Most healthy people do not develop Legionnaires’ disease even if they are exposed to *Legionella* bacteria. People at higher risk for Legionnaires’ disease include those who are aged 50 years or older, people with chronic lung disease or other chronic conditions, or people taking immunosuppressive medications.
• The majority (74%) of people diagnosed with Legionnaires’ disease in 2017 were adults aged 55 years or older. Almost all those diagnosed (99%) reported at least one chronic health condition, most commonly diabetes (31%) or lung disease (27%).
• Over half (63%) of people diagnosed with Legionnaires’ disease in 2017 reported a history of smoking.
• Men were nearly twice as likely as women to be diagnosed with Legionnaires’ disease (6.5 and 3.8 per 100,000 people, respectively). Among all racial groups, non-Hispanic Black New Yorkers had the highest rate of disease (7.6 per 100,000 people).
• In 2017, most Legionnaires’ disease cases (26%) occurred in Queens; however, the Bronx had the highest rate (7.0 cases per 100,000 people).

1 |
When does the Health Department investigate Legionnaires’ disease cases?

The Health Department follows up on every Legionnaires’ disease case diagnosed in New York City and continuously monitors for clusters of cases that might be related to a common environmental source of *Legionella* bacteria exposure.

- **Community cluster investigations**: The Health Department investigates cases of Legionnaires’ disease that cluster closely in time and geography among people who live in different buildings. This pattern of disease indicates a possible community source of exposure, such as a cooling tower. The Health Department routinely evaluates nearby cooling towers when there are community clusters of Legionnaires’ disease.
  - The Health Department investigated two community clusters in 2017: one in Queens and one in Manhattan.
  - The Health Department sampled a total of 165 cooling tower systems as a part of these investigations.

- **Building water system evaluations**: The Health Department routinely evaluates the water system in a building when two or more residents of the building are diagnosed with Legionnaires’ disease within 12 months of each other. The Health Department also routinely evaluates a building water system when a single case occurs in a person who spent the entirety of the disease incubation period in a higher-risk setting (e.g., shelter or assisted living facility).
  - The Health Department conducted evaluations of eight NYC building water systems in 2017.
  - The Health Department oversaw the collection of more than 400 building water system samples as part of these evaluations.
Contents
I. Legionnaires’ Disease in NYC Over Time................................................................. 4
II. Geographic Distribution of Legionnaires’ Disease................................................... 5
III. Demographic and Clinical Characteristics............................................................. 6
IV. Cluster Detection Methods and Investigation Summary......................................... 7
V. Appendices............................................................................................................. 9
   Appendix A: Trends in Reported Legionnaires’ Disease Rates Nationwide, 2010-2017*.............................................. 9
   Appendix B: Legionnaires’ Disease Rates by Neighborhood Tabulation Area, NYC, 2017 ..................................... 11
VI. References.......................................................................................................... 14
I. Legionnaires’ Disease in NYC Over Time

Figure 1.1 Number and Rate of Reported Legionnaires’ Disease Cases*, NYC, 2000-2017‡

*Numbers represent all confirmed cases of legionellosis, which includes Legionnaires’ disease and a flu-like illness called Pontiac fever. Pontiac fever makes up fewer than 2% of reported legionellosis cases each year.
†2015 South Bronx Legionnaires’ Disease Outbreak: An outbreak linked to a cooling tower in the South Bronx involved 133 NYC residents with illness onset July 2 to August 3, 2015. In response, the Health Department added rules to the New York City Administrative Code that placed new requirements on building owners concerning the registration, inspection and maintenance of cooling towers.
‡For national trends, see Appendix A.

The rate of Legionnaires’ disease has increased significantly in NYC. Between 2007 and 2017, disease rates increased in all NYC boroughs and demographic groups. This increase may reflect an older population, aging plumbing infrastructure or changing weather patterns. Increased use of diagnostic testing may also influence the rate of disease. Similar increasing rates of Legionnaires’ disease have been seen across the United States. Data from the CDC show that rates of Legionnaires’ disease have increased in 83% of reporting jurisdictions during 2010-2017. During that period, 18 states had an average annual percent increase in cases that was larger than the increase in NYC (Appendix A).

Table 1.1: Trends in Legionnaires’ Disease Rates per 100,000 People by Demographic Groups, NYC*, 2007-2017

<table>
<thead>
<tr>
<th>Group</th>
<th>2007</th>
<th>2017</th>
<th>AAPC</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2.3</td>
<td>5.1</td>
<td>8.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.4</td>
<td>3.8</td>
<td>9.2</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Male</td>
<td>3.2</td>
<td>6.5</td>
<td>7.4</td>
<td>0.01</td>
</tr>
<tr>
<td>Race and Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black/African American (NH)</td>
<td>2.5</td>
<td>7.6</td>
<td>11.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>1.6</td>
<td>3.3</td>
<td>8.3</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>White (NH)</td>
<td>2.2</td>
<td>5.4</td>
<td>8.3</td>
<td>0.01</td>
</tr>
<tr>
<td>Asian (NH)</td>
<td>0.4</td>
<td>2.4</td>
<td>21.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Age Group (Years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35 years</td>
<td>0.2</td>
<td>1.6</td>
<td>9.3</td>
<td>0.03</td>
</tr>
<tr>
<td>35 to 54 years</td>
<td>1.5</td>
<td>2.5</td>
<td>4.4</td>
<td>0.11</td>
</tr>
<tr>
<td>55 to 64 years</td>
<td>4.0</td>
<td>8.6</td>
<td>9.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>65 to 74 years</td>
<td>3.2</td>
<td>10.1</td>
<td>11.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>75 to 84 years</td>
<td>6.1</td>
<td>11.0</td>
<td>6.2</td>
<td>0.01</td>
</tr>
<tr>
<td>≥85 years</td>
<td>5.2</td>
<td>10.2</td>
<td>7.9</td>
<td>0.03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>2007</th>
<th>2017</th>
<th>AAPC</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borough of Residence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronx</td>
<td>4.1</td>
<td>7.0</td>
<td>6.6</td>
<td>0.02</td>
</tr>
<tr>
<td>Brooklyn</td>
<td>1.8</td>
<td>3.4</td>
<td>4.8</td>
<td>0.02</td>
</tr>
<tr>
<td>Manhattan</td>
<td>2.7</td>
<td>6.4</td>
<td>9.4</td>
<td>0.01</td>
</tr>
<tr>
<td>Queens</td>
<td>1.5</td>
<td>4.8</td>
<td>11.0</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Staten Island</td>
<td>1.5</td>
<td>5.7</td>
<td>15.7</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neighborhood Poverty Level</th>
<th>2007</th>
<th>2017</th>
<th>AAPC</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;10% below FPL)</td>
<td>2.0</td>
<td>4.8</td>
<td>7.3</td>
<td>0.02</td>
</tr>
<tr>
<td>Medium (10 to &lt;20% below FPL)</td>
<td>1.6</td>
<td>4.5</td>
<td>9.2</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>High (20 to &lt;30% below FPL)</td>
<td>2.3</td>
<td>4.6</td>
<td>5.7</td>
<td>0.03</td>
</tr>
<tr>
<td>Very High (≥30% below FPL)</td>
<td>3.2</td>
<td>6.4</td>
<td>9.6</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Abbreviations: AAPC, average annual percent change; FPL, federal poverty level; NH, non-Hispanic.


* For national trends, see Appendix A.
Legionnaires’ disease rates vary substantially across NYC’s neighborhoods. Annual neighborhood rates can be particularly variable (Figure 2.1), while longer-term rates are more stable (Figure 2.2). Multiple factors likely contribute to the occurrence and detection of Legionnaires’ disease in neighborhoods with the highest rates of disease. Many neighborhoods with the highest rates of disease also have the highest rates of poverty (Figures 2.2 and 2.3). The variation in longer-term neighborhood rates may reflect geographic variations in health conditions that increase the risk of Legionnaires’ disease, different environmental exposures or different testing practices. Health conditions that increase the risk of Legionnaires’ disease include smoking, chronic lung disease, diabetes and other chronic conditions that suppress the immune system. Environmental sources of Legionella bacteria may vary by neighborhood, based on the type and maintenance of infrastructure in the area, including cooling tower systems (Figure 2.4). In addition, the rate of testing for Legionnaires’ disease may not be uniform across the city due to variations in health system practices.

Abbreviations: FPL, federal poverty level.

Data sources: Cooling tower data are from the NYC DOHMH Cooling Tower Registry. Population and poverty data are from NYC DOHMH population estimates, modified from US Census Bureau intercensal population estimates, 2000-2016. Updated September 2017.

*See Appendix B for 2017 count and rate values by NTA.
III. Demographic and Clinical Characteristics

Table 3.1: Legionnaires’ Disease Case Reporting Summary, NYC, 2017

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed Cases</td>
<td>435</td>
<td>100%</td>
</tr>
<tr>
<td>Method of Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine antigen test (UAT) only</td>
<td>403</td>
<td>93%</td>
</tr>
<tr>
<td>Bacterial culture only</td>
<td>10</td>
<td>2%</td>
</tr>
<tr>
<td>Bacterial culture and UAT</td>
<td>14</td>
<td>3%</td>
</tr>
<tr>
<td>Missing/unknown</td>
<td>8</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case Classification</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community-associated</td>
<td>382</td>
<td>88%</td>
</tr>
<tr>
<td>Possible health care-associated*</td>
<td>22</td>
<td>5%</td>
</tr>
<tr>
<td>Definite health care-associated*</td>
<td>31</td>
<td>7%</td>
</tr>
</tbody>
</table>

* Person spent some (1-9) or all (≥10) nights during their disease incubation period in an Article 28 health care facility (See: health.ny.gov/facilities/hospital/regulations).

Table 3.2: Demographic Characteristics of People Diagnosed With Legionnaires’ Disease, NYC, 2017

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed Cases</td>
<td>435</td>
<td>100%</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>171</td>
<td>39%</td>
</tr>
<tr>
<td>Male</td>
<td>264</td>
<td>61%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (min, max)</td>
<td>64 (24, 102)</td>
<td></td>
</tr>
<tr>
<td>&lt;35 years</td>
<td>23</td>
<td>5%</td>
</tr>
<tr>
<td>35 to 54 years</td>
<td>94</td>
<td>22%</td>
</tr>
<tr>
<td>55 to 64 years</td>
<td>95</td>
<td>22%</td>
</tr>
<tr>
<td>65 to 74 years</td>
<td>100</td>
<td>23%</td>
</tr>
<tr>
<td>≥85 years</td>
<td>51</td>
<td>12%</td>
</tr>
<tr>
<td>Race and Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>83</td>
<td>19%</td>
</tr>
<tr>
<td>Black/African American (NH)</td>
<td>144</td>
<td>33%</td>
</tr>
<tr>
<td>White (NH)</td>
<td>148</td>
<td>34%</td>
</tr>
<tr>
<td>Asian (NH)</td>
<td>30</td>
<td>7%</td>
</tr>
<tr>
<td>Other (NH)</td>
<td>4</td>
<td>1%</td>
</tr>
<tr>
<td>Unknown</td>
<td>25</td>
<td>6%</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Borough of Residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronx</td>
<td>102</td>
<td>23%</td>
</tr>
<tr>
<td>Brooklyn</td>
<td>88</td>
<td>20%</td>
</tr>
<tr>
<td>Manhattan</td>
<td>105</td>
<td>24%</td>
</tr>
<tr>
<td>Queens</td>
<td>113</td>
<td>26%</td>
</tr>
<tr>
<td>Staten Island</td>
<td>27</td>
<td>6%</td>
</tr>
<tr>
<td>Neighborhood Poverty Level*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;10% below FPL)</td>
<td>106</td>
<td>24%</td>
</tr>
<tr>
<td>Medium (10% to &lt; 20% below FPL)</td>
<td>113</td>
<td>26%</td>
</tr>
<tr>
<td>High (20% to &lt;30% below FPL)</td>
<td>84</td>
<td>19%</td>
</tr>
<tr>
<td>Very high (≥30% below FPL)</td>
<td>125</td>
<td>29%</td>
</tr>
<tr>
<td>Residence During Disease Incubation Period†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apartment/private home</td>
<td>344</td>
<td>79%</td>
</tr>
<tr>
<td>Long-term care/nursing home</td>
<td>32</td>
<td>7%</td>
</tr>
<tr>
<td>Homeless/shelter</td>
<td>23</td>
<td>5%</td>
</tr>
<tr>
<td>Assisted living facility</td>
<td>4</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>2%</td>
</tr>
<tr>
<td>Missing/unknown</td>
<td>22</td>
<td>5%</td>
</tr>
</tbody>
</table>

* Cases involving an incorrect or missing address not included (n=7).
† The incubation period is the 10 days prior to the date of symptom onset.

The majority of Legionnaires’ disease cases are diagnosed by urine antigen test (UAT). Clinical bacterial cultures are necessary for cases to be linked to potential environmental sources. However, bacterial cultures are infrequently available because they are difficult to obtain and take time to yield results necessary for clinical treatment decisions. Clinical bacterial cultures were available for only 5% of cases in 2017, thus limiting the opportunity for environmental source matching to clinical cases.

People who spend time in hospitals or nursing homes are at higher risk for Legionnaires’ disease. This higher disease risk exists because people in health care settings are more likely to have health conditions or receive treatments that suppress their immune systems. The Health Department refers cases that occur in people who spent one or more nights during their disease incubation period (the 10 days before feeling sick) in a hospital or nursing home to New York State for further follow-up and possible environmental testing of the health care facility.

A small percent of Legionnaires’ disease cases (12%) in 2017 occurred among individuals who spent at least one night in a health care facility during their 10-day disease incubation period. Nearly 90% of cases occurred in people who did not report staying overnight in a health care facility in the 10 days before they first felt sick.

In 2017, Legionnaires’ disease did not occur at the same rate across all demographic groups. Rates of Legionnaires’ disease were higher among men than women, higher among older people, and higher among people living in poverty.

Abbreviations: FPL, federal poverty level; NH, non-Hispanic.
Table 3.3: Clinical Characteristics of People Diagnosed With Legionnaires’ Disease, NYC, 2017

<table>
<thead>
<tr>
<th>Medical Condition</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed Cases</td>
<td>435</td>
<td>100%</td>
</tr>
<tr>
<td>Underlying Medical Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>430</td>
<td>99%</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Unknown/missing</td>
<td>2</td>
<td>0%</td>
</tr>
</tbody>
</table>

Common conditions (not mutually exclusive)

- Diabetes: 133 (31%)
- Lung disease: 117 (27%)
- Cancer: 73 (17%)
- HIV: 43 (10%)
- Alcoholism: 36 (8%)
- AIDS: 12 (3%)
- Kidney failure: 19 (4%)
- Other chronic condition: 337 (77%)

Smoking Status

- Any history of smoking: 272 (63%)
- Current smoker: 126 (29%)
- Former smoker: 146 (34%)
- No history of smoking: 132 (30%)
- Unknown/missing: 31 (7%)

Most healthy people do not develop Legionnaires’ disease even if they are exposed to *Legionella* bacteria. People who smoke or have chronic health conditions are at greater risk for Legionnaires’ disease. Among people with cases of Legionnaires’ disease in 2017, 99% had at least one chronic medical condition and 63% were previous or current smokers. The most commonly reported medical condition was diabetes (31%), followed by lung disease (27%).

*Legionella* bacteria are found naturally in the environment, meaning that exposure can occur from a variety of sources. As part of the surveillance process, DOHMH interviews each diagnosed person about their water use to identify common sources of exposure. However, it is rare that patient interviews identify possible common sources of exposure for different people. In 2017, the majority of people with cases of Legionnaires’ disease (73%) did not report any exposure to aerosols outside their home, water service disruption in their homes, or exposure to aerosols in their homes beyond routine water use. For this reason, the Health Department routinely initiates an evaluation of a building’s water system if two or more cases occur within 12 months in residents of the building, as this may indicate a common source of exposure (see ‘Building Water System Evaluations’ on page 8).
IV. Cluster Detection Methods and Investigation Summary

The Health Department routinely analyzes Legionnaires’ disease surveillance data to identify possible clusters of cases. Depending on the location and timing of cases, as well as the presence of possible common exposures, the Health Department might initiate one of the following responses:

- **Community cluster investigation**: The Health Department investigates cases of Legionnaires’ disease that cluster closely in time and geography among people who live in different buildings. This pattern of disease indicates a possible community source of exposure, such as a cooling tower. The Health Department routinely evaluates nearby cooling towers when there are community clusters of Legionnaires’ disease.

- **Building water system evaluation**: The Health Department routinely evaluates the water system in a building when two or more residents of the building are diagnosed with Legionnaires’ disease within 12 months of each other. The Health Department also routinely evaluates a building water system when a single case occurs in a person who spent the entirety of the disease incubation period in a higher-risk setting (e.g., shelter or assisted living facility).

### Table 4.1: Health Department Response Summary, 2017

<table>
<thead>
<tr>
<th>Responses</th>
<th>Responses Resulting in Identification of a <em>Legionella</em>-Positive* Building Water System or Cooling Tower</th>
<th>≥1 Clinical and Environmental <em>Legionella</em> Isolate Match†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Building Water System Evaluations</td>
<td>8</td>
<td>4 (50%)</td>
</tr>
<tr>
<td>Community Cluster Investigations</td>
<td>2</td>
<td>2 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>8 (80%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 (10%)</td>
</tr>
</tbody>
</table>

* *Legionella*-positive building water systems are identified by water samples showing growth of any *Legionella* species on bacterial culture; *Legionella*-positive cooling towers are identified in a community cluster investigation by one or more water sample showing growth of *Legionella pneumophila* on bacterial culture.

†*Legionella* bacteria isolated from a clinical specimen and an environmental sample match via whole genome sequencing.

### Figure 4.1 Community Cluster Investigations and Building Water System Evaluations, 2017

[Map depicting community cluster investigations and building water system evaluations, 2017]
Appendix A: Trends in Reported Legionnaires’ Disease Rates Nationwide, 2010-2017*

Data Sources for Appendix A:

- Legionnaires’ disease 2010-2017 data: Centers for Disease Control and Prevention (CDC). National Notifiable Diseases Surveillance System, Annual Tables of Infectious Disease Data.6-11
- Average annual percent change (AAPC) calculated using Joinpoint software for analysis of trend over time.12

Table A1. Legionnaires’ Disease Rates by State, U.S., 2010-2017

<table>
<thead>
<tr>
<th>State</th>
<th>2010 Rate (per 100,000)</th>
<th>2017 Rate (per 100,000)</th>
<th>% Change</th>
<th>AAPC</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>New England</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecticut</td>
<td>1.56</td>
<td>3.22</td>
<td>105.68</td>
<td>7.27</td>
<td>0.09</td>
</tr>
<tr>
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*2016 rate; 2017 not reported
## Appendix B. Legionnaires’ Disease Rates by Neighborhood Tabulation Area, NYC, 2017

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VI. References

11. Centers for Disease Control and Prevention. National Notifiable Diseases Surveillance System, Weekly Tables of Infectious Disease Data. Atlanta, GA. CDC Division of Health Informatics and Surveillance. (Week 52. Note: Case counts for reporting year 2017 are provisional and subject to change.)