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## INTRODUCTION

- Legionnaires' disease (LD) is a severe pneumonia caused by inhalation or aspiration of water contaminated with the bacterium *Legionella pneumophila*. LD is treatable but can be fatal in persons with comorbidities who delay seeking care. LD is underdiagnosed.
- Known risk factors for LD include older age, smoking, lung disease, residence in high poverty areas, and immune system compromise.
- The rate of LD in New York City (NYC) has risen from 2.3/100,000 in 2006 to 5.2/100,000 in 2015.
- In 2015, NYC experienced a large outbreak of community-acquired LD in the South Bronx, resulting in 138 cases and 16 deaths, with a high rate of comorbidities, including HIV.
- We analyzed the associations between HIV status and community-acquired LD diagnosis and death in NYC from 2006–2015.

## METHODS

### Inclusion criteria

- Confirmed and suspected cases of community-acquired LD among NYC residents diagnosed during 2006–2015 were included. Definite or possible nosocomial cases were excluded.

### Data collection

- The NYC DOHMH communicable disease surveillance database contains electronic reports of LD, supplemented with information on underlying medical conditions and patient outcome from case investigations.
- Data were matched to NYC's HIV surveillance registry.

### Data analysis

- Bivariate: chi square tests used to compare:
  - LD cases with NYC population, stratified by sex, age category, HIV status, neighborhood poverty, South Bronx residency
  - LD deaths with LD non-fatal cases, stratified by sex, age category, HIV status, neighborhood poverty, South Bronx residency
  - HIV prevalence among 2015 South Bronx outbreak cases with HIV prevalence among community-acquired cases from 2006–2014 who resided in the South Bronx outbreak zone
- Multivariable logistic regression used to model associations, using individual and neighborhood level patient characteristics:
  - Odds ratio (OR) for LD by HIV status, among NYC population
    - Interaction between HIV status and South Bronx outbreak zone residence, and South Bronx residence and year
    - Separate models to adjust for sex (model A) and age category (model B) because of availability of population denominators
  - OR for death among LD cases attributable to: age category, sex, HIV status, neighborhood poverty level, lung disease, former smoking, current smoking, diabetes, prior cancer diagnosis, or presence of any comorbidity.

## Total cases of Legionnaires' Disease

- There were 2041 cases of community-acquired Legionnaires' Disease among New York City residents diagnosed during 2006–2015.

## Associations with Legionnaires' Disease among the NYC population

### Bivariate analysis

- Legionnaire's Disease was significantly associated with sex, age category, HIV status, South Bronx residency, and neighborhood poverty level (data not shown).
- HIV prevalence was higher among 2006–2014 South Bronx cases (31%) than among 2015 South Bronx outbreak-associated cases (18%) ( $p=0.02$ ).

### Multivariable analysis (Table 1)

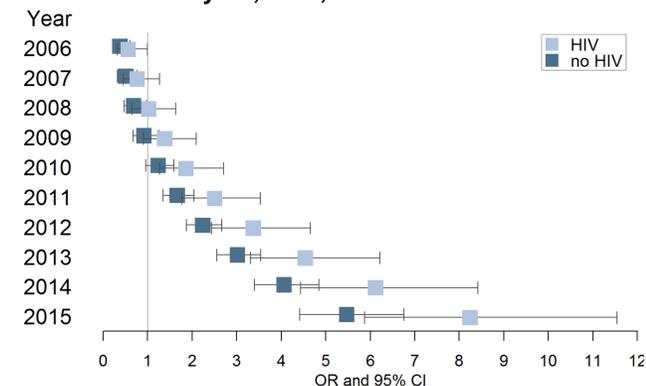
- Model A: Sex, HIV status and South Bronx residency interaction, and year and South Bronx residency interaction were associated with Legionnaires' Disease outcome.
- Model B: HIV status, age category, and year and South Bronx residency interaction were associated with Legionnaires' Disease outcome.

**Table 1. Multivariable associations with Legionnaires' Disease, NYC, 2006–2015.**

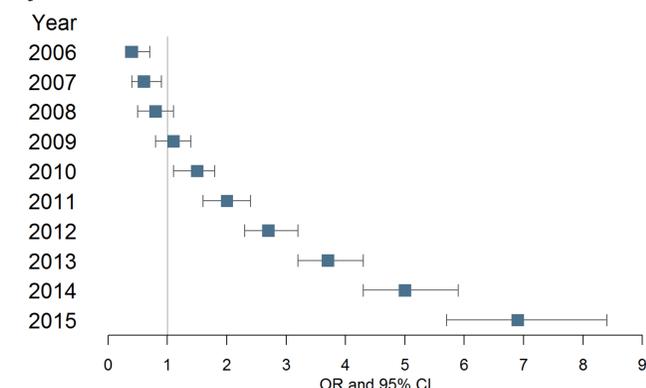
Characteristic	Adjusted OR (95% CI)
<b>Model A: with sex</b>	
<b>Sex</b>	
Male	1.7 (1.6-1.9)
Female	Reference
<b>HIV status (Figure 3)</b>	
South Bronx resident	11.2 (8.2-15.4)
Non-South Bronx resident	7.5 (6.4-8.7)
<b>South Bronx residency*year</b>	
	See Figure 1
<b>Model B: with age category</b>	
<b>HIV status</b>	
	6.4 (5.5-7.3)
<b>Age category</b>	
0-39	Reference
40-49	6.8 (5.6-8.1)
50-59	12.1 (10.2-14.4)
60+	18.5 (15.7-21.8)
<b>South Bronx residency*year</b>	
	See Figure 2

## RESULTS

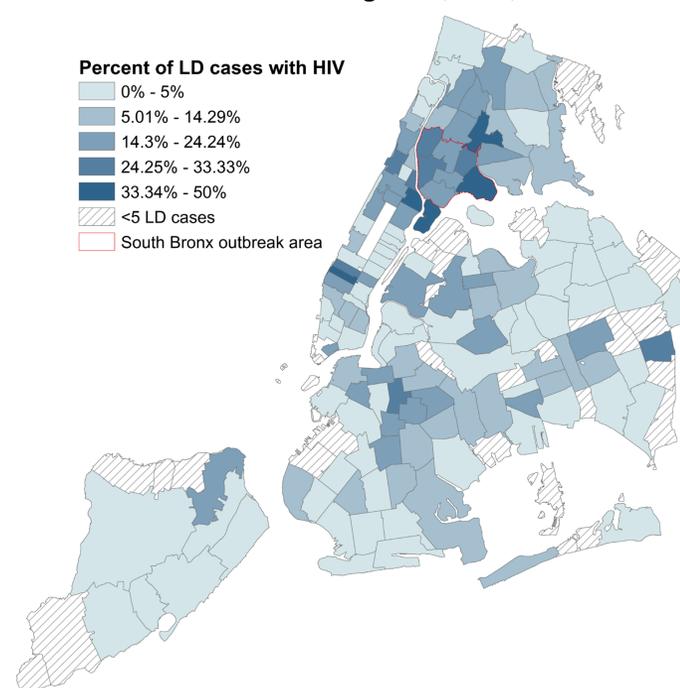
**Figure 1. Multivariable Model A: Odds of LD among South Bronx residents vs. other NYC residents, by HIV status and year, NYC, 2006–2015.**



**Figure 2. Multivariable Model B: Odds of LD among South Bronx residents vs. other NYC residents, by year, NYC, 2006–2015.**



**Figure 3. Proportion of LD cases with known HIV infection at the time of diagnosis, NYC, 2006–2015.**



## Associations with death among LD cases

- Bivariate:** Age category (older age), sex (male versus female), lung disease, former smoking, and prior cancer diagnosis were independently associated with LD death (data not shown).
- Multivariable:** older age, lung disease, and prior cancer diagnosis increased the odds of LD death (Table 2).

**Table 2. Multivariable associations with LD death, NYC, 2006–2015.**

Characteristic	Adjusted OR (95% CI)
<b>Age category</b>	
0-39	Reference
40-49	1.6 (0.7-3.9)
50-59	1.3 (0.6-3.0)
60+	3.0 (1.4-6.5)
<b>Lung disease</b>	
Cancer	2.3 (1.6-3.3)

## CONCLUSIONS

- People living with HIV/AIDS are at significantly increased risk for LD citywide.
    - This association is more pronounced among South Bronx residents.
  - LD risk in South Bronx residents compared with other NYC residents increased during 2006–2015.
  - The 2015 South Bronx outbreak had a lower proportion of cases with HIV/AIDS than historical cases from the South Bronx.
  - Providers should consider testing people living with HIV/AIDS presenting with pneumonia for LD.
- Limitations**
- Unable to stratify age categories above 60 years because of small numbers of people living with HIV.
  - Lack of detailed population-level data on comorbidities precluded further confounder adjustment.
  - Insurance status and access to health care, which are often associated with neighborhood poverty level, may confound associations with disease.