Correlation of Occurrence of *Legionella pneumophila* and Blastomycosis Cases Within ZIP Codes: Eastern Wisconsin

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**Methods**

**Study Design**: Secondary data analyses of two Eastern Wisconsin laboratory registries from overlapping 5-year time periods.

**Setting/Dataset/Population Studied**: Cases, by ZIP code, of positive *Legionella pneumophila* urine antigen tests (fits CDC criteria for diagnosis), 2013-2017, and laboratory-confirmed blastomycosis cases, 2015-2019, from 4 urban/suburban Eastern Wisconsin 53xxx ZIP code groups.

**Outcome Measures/Statistics**: Estimated incidence figures for each disease were calculated from our previously published analysis data (refs 1,2). Pearson correlation was calculated, and linear regression was performed with *LpP* case distribution as outcome variable, blastomycosis distribution as predictor variable.

**Results**

- Yearly predicted *LpP* and blastomycosis cases in the Aurora Wisconsin catchment area were 27 and 24, respectively, such that a 1:1 distribution was assumed. This was confirmed by results: 136 cases each in 5-year time spans.
  - Pearson correlation of distribution of *LpP* and blastomycosis cases by ZIP code was moderate at 0.541 (p<0.001).
  - Of 136 ZIP codes from 11 counties studied, 61 had no *LpP* or blastomycosis cases, 35 both types of cases, 24 only *LpP* cases, 16 only blastomycosis.
  - Blastomycosis case distribution was a significant predictor of *LpP* cases in a linear regression model (p<0.001) with equation: 
    \[ \text{LpP cases by ZIP} = 0.419 + 0.636(\text{number of blastomycosis cases}) \]
    \[ R\text{-squared (adj)} = 28.7\% \]

**Background**

- *Legionella pneumophila* (intracellular bacteria) pneumonia (*LpP*) and blastomycosis (dimorphic fungi, *Blastomyces*) are potentially serious environmentally acquired infections which are both prevalent in Eastern North America, including Wisconsin.
  - There is good evidence that blastomycosis is associated with fresh water systems, including urban/suburban rivers such as the one pictured below (*Figure 1*).

- There is preliminary evidence that some *LpP* may be associated with fresh waterways as well.

- If the acquisition of both diseases is similarly associated with a geographic feature, one might expect similar geographic distributions of case addresses.

**Objective**

To perform a (very) preliminary exploratory analysis of the correlation of the distribution of *LpP* and blastomycosis cases among ZIP codes in Eastern Wisconsin.

**Conclusions**

This preliminary, modest correlation of the ZIP code distribution of *LpP* and blastomycosis is intriguing given known association of *LpP*, but not blastomycosis, with human built water sources. Correlation was seen despite both diseases presenting with endemic infections as well as outbreaks. Such a correlation may suggest an undescribed common outdoor environmental source.

Further study of *LpP* and blastomycosis co-associations with waterways, and other potential common sources (or potential common environmental hosts such as the ubiquitous *Acanthamoeba* which can harbor both) seems warranted.

**References**