Introduction
Legionella species commonly causes 2 clinical symptoms, Legionnaires' disease and Pontiac fever. Legionnaires' disease is an acute and lethal pneumonia whereas Pontiac fever is flu-like, self-limiting illness. According to the CDC, Legionnaires' disease has increased 217% in incidence from 2000 to 2005. (Lee M. Hampton, et al.)

Bacterial pneumonia is divided into typical and atypical pneumonia. Legionella pneumophila (Lp) is considered one of the primary etiologies of "atypical pneumonia". On the other hand, Streptococcus pneumoniae (Sp) is considered the primary etiology of "typical pneumonia". The traditional thought that patients with typical and atypical pneumonia have different underlying conditions and different clinical outcomes has been challenged recently.

The objective of this study was to define if hospitalized patients with CAP due to Legionella pneumophila have different underlying conditions and clinical outcomes compared to patients with Streptococcus pneumoniae.

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ABSTRACT

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MATERIALS AND METHODS

Study Design
This was a secondary analysis of patients enrolled in the Community-Acquired Pneumonia Organization (CAPAO) international cohort study. Data were collected between 2001 and 2015. In each participating center, non-consecutive medical records of hospitalized patients with the diagnosis of CAP were reviewed. A sample of the data collection form is available at the study website (www.capao site). Validation of data quality was performed at the study center before the case was entered into the CAPAO database. Institutional Review Board approval was obtained by each participating center.

Study Definitions
CAP: Diagnosis of CAP required the presence of criteria A, B, and C:
A. New or increased cough (per the patient)
B. Flare >37.8°C (100.0°F) or hypothermia <35.6°C (96.0°F).
C. Changes in WBC (leukocytosis >10,000 cells/mm³), left shift >10% band forms/microtubes, or leukopenia <4,000 cells/mm³.

C. Working diagnosis of CAP at the time of hospital admission with antimicrobial therapy given within 24 hours of admission.

Study Groups
Group 1: patients with CAP and positive Lp urinary antigen test obtained upon admission to the hospital.
Group 2: patients with CAP and positive Sp urinary antigen test obtained in hospitalization.

Study Outcomes

Time to clinical stability (TCS): A patient was defined as clinically stable the day that the following four criteria were met: a) improved cough and shortness of breath, b) no lack of fever for at least 8 hours, c) improving leukocytosis (decreased at least 10% from the previous day), and d) tolerating oral intake with adequate gastrointestinal absorption. Patients were evaluated daily within the first 7 days of hospitalization to determine the day when clinical stability was reached.

Length of stay (LOS): Defined in days and calculated for each patient as the day of discharge minus the day of admission. Patients hospitalized for more than 14 days were censored at 15 days in an effort to capture LOS data related only to bacterial CAP.

In-hospital mortality: defined as death by any cause during hospitalization.

Statistical Analyses
Baseline categorical explanatory variables were summarized as frequencies and percentages and differences between both groups of patients were analyzed using a chi-square test or Fisher's exact test when appropriate and warranted. Continuous variables were summarized as frequencies and interquartile range and differences between groups of patients were analyzed by Wilcoxon-Mann-Whitney test.

TCS and LOS were analyzed with the Kaplan-Meier method, and log-rank tests were applied to evaluate differences between both groups of patients. P-values ≤ 0.05 were considered statistically significant.

RESULTS
A total of 95 patients with Legionella pneumophila and 339 patients with Streptococcus pneumoniae were analyzed.

Table 1: Patients Demographics, Comorbid Conditions, Physical Exam, Lab/ Radiography and Severity of Disease variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Legionella</th>
<th>Streptococcus</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± SD, range)</td>
<td>61 ± 14 (21-90)</td>
<td>62 ± 17 (18-95)</td>
<td>0.323</td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td>35:60</td>
<td>123:216</td>
<td>0.015</td>
</tr>
<tr>
<td>Race (White:Non-White)</td>
<td>45:50</td>
<td>160:179</td>
<td>0.936</td>
</tr>
<tr>
<td>BMI (mean ± SD, range)</td>
<td>25 ± 4 (12-45)</td>
<td>26 ± 5 (13-50)</td>
<td>0.032</td>
</tr>
<tr>
<td>Serum glucose, Median (IQR)</td>
<td>120 (79-152)</td>
<td>120 (70-155)</td>
<td>0.034</td>
</tr>
<tr>
<td>Altered mental status on admission, n (%)</td>
<td>120 (33)</td>
<td>79 (23)</td>
<td>0.003</td>
</tr>
</tbody>
</table>

There was no clinically significant difference between the groups in regard to hospital mortality (RR 0.866, 95%CI:0.325-2.307; p-value=0.773).

Figure 1: Time to clinical stability (TCS) for both study groups

Figure 2: Length of Stay (LOS) in the hospital for both study groups

CONCLUSIONS

- This study indicated that Legionella pneumophila and Streptococcus pneumoniae infect similar patients and produce similar outcome.
- Since patients infected with these two primary atypical and typical pathogens have similar clinical characteristics, the initial empiric antibiotics therapy for all hospitalized patients with CAP should cover for the possibility of Legionella pneumophila and Streptococcus pneumoniae.

REFERENCES

2. Luttrell EL. "Clinical presentation and outcomes of hospitalized patients with Legionella pneumophila versus Streptococcus pneumoniae community-acquired pneumonia (CAP)." Kuldeep Ghosh, Maria Rosa Velasquez, Muntader Khaleefah, Claudio Moisa, Francisco Fernandez, Paula Feyrani, Forest Arnold, Raul Nakamatsu University of Louisville, School of Medicine, Division of Infectious Diseases

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