Missed and Delayed Diagnosis of *Pneumocystis* Pneumonia in HIV and non-HIV-Infected Individuals

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**Introduction**

*Pneumocystis pneumonia* (PcP) is a potentially severe infection. PcP affects immunosuppressed patients including people with HIV, organ transplant recipients, and patients receiving steroids and other immunosuppressive medications.

Cases among people with HIV are decreasing. However, PcP cases have been increasing among people on immunosuppressive therapy as the number of people on immunosuppressive medications has increased.

Standard empiric therapy for community acquired pneumonia does not treat PcP thus, effective treatment requires a timely diagnosis of PcP. Diagnostic delays can increase morbidity and mortality attributable to PcP, but little is known about the frequency of PcP-related diagnostic delays.

**Methods**

Retrospective cohort study using Truven Marketscan Commercial Claims and Encounters Database 2011-2016

- >105 million enrollees
- Longitudinal inpatient, outpatient and prescription drugs

**Identifying Diagnostic Delays:**

- Identify index PcP diagnosis (first diagnosis)
- Look for prior visits with PcP-related symptoms: cough, dyspnea, pneumonia, influenza, tonsillitis, bronchitis, other upper respiratory infection, COPD, fever.

**Analyzing/Validating Diagnostic Delays:**

- A time-series change-point analyses was used to detect point before index PcP diagnosis where symptoms began to emerge (increase in occurrence)
- Simulation analysis used to estimate the frequency of true diagnostic delays. Compare randomly drawn "expected" symptoms to to observed symptoms.
- Analyzed risk factors for potential delays using logistic regression.

**Results**

We identified 7,656 case patients with PcP: 5,187 in patients with HIV and 2,469 in patients without HIV.

There were 15,963 visits from 4,674 patients, with PcP-related symptoms prior to the index PcP diagnosis. There is a dramatic spike in the number of visits with PcP-related symptoms in the weeks prior to the index PcP diagnosis (Figure 1). The increase is more gradual in patients without HIV, suggesting potentially longer diagnostic delays.

**Discussion/Conclusions**

Diagnostic delays appear to be common among patients ultimately diagnosed with PcP.

Delays occur among both people with and without HIV. However, delays among people without HIV are longer (median 16 days) when compared to people with HIV (median 11 days).

At visits prior to the diagnostic visit, patients present with common respiratory-related complaints.

Diagnostic delays for PcP are less common in inpatient settings (odds ratio: 0.107).

Given the relatively high numbers of patients who experience a delay and the duration of the delays, new approaches are needed:

- Identify patients at risk for PcP sooner;
- Expand access to diagnostic testing;
- Improve diagnostic testing;
- Increase clinical suspicion for PcP for patients taking immunosuppressive medications;
- Determine and refine risk factors for PcP for patients taking immunosuppressive medications.

**Limitations and Future Studies**

- Administrative claims data alone cannot be used to validate diagnosis or delay (no microbiology results are contained in the data set).
- This work did not consider medication use. For example, this analysis did not consider what immunosuppressive medications patients were taking prior to being diagnosed with PcP.
- Future work should validate diagnostic delay results using clinic/EMR records.
- Future work should investigate building models to forecast PcP and develop decision rules.
- Future work should investigate outcomes associated with diagnostic delays for PcP.