**BACKGROUND**

- Idiopathic pulmonary fibrosis (IPF), a specific form of chronic, progressive fibrosis of unknown cause, is a highly medical condition.

- Managing IPF patients requires resource-intensive management to avoid the complexity of reaching a confirmed diagnosis and the need for managing comorbidities.

- United States Census nationally representative data regarding the economic burden of IPF in the elderly are limited.

The purpose of this study is to examine the health resource utilization (HRU) and costs associated with IPF in people ages 65 and older in the US.

**METHODS**

### Data Sources

- Parts A and B claims data of a 5% random sample of Medicare beneficiaries between the years 2000 and 2011 from the Centers for Medicare & Medicaid Services.

- Information available from the enrollment file includes year of birth, gender, race, date of death (if deceased), reason for Medicare entitlement, and Medicare Advantage (health maintenance organization) enrollment.

- Information available from the claims includes calendar quarter and year of service, up to 12 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes, Current Procedure Terminology (CPT), and Healthcare Common Procedure Coding System (HCPCS) procedure codes, provider specialty, charges, and Medicare payment amounts.

### Patient Cohort Identification

- The study population consisted of beneficiaries who received Medicare coverage due to age and who did not have end-stage renal disease (ESRD).

- Newly diagnosed IPF cases were identified following the algorithm below:
  - With at least one claim with ICD-9-CM diagnosis code 512.3 (idiopathic fibrosing alveolitis) between January 1, 2000 and December 31, 2010.
  - Without other diagnosis code for interstitial lung disease (ILD) after the last claim with ICD-9-CM diagnosis code 512.3 except the exclusion of ICD-9-CM diagnosis code 515 (inflammatory interstitial pneumonias) due to providers’ common use of this more general diagnostic code for IPF.
  - With at least one year of continuous coverage of Medicare Parts A and B, without enrollment into Medicare Advantage Plans, before and after the first IPF diagnosis.
  - Index quarter with the first IPF diagnosis.
  - Excluded if no matched controls can be selected.

- Annual HRU, total costs, and costs by setting during the one-year pre- and post-index periods were measured.

- All costs were adjusted to 2012 value based on the Consumer Price Index Medical Component.

### Statistical Analysis

- The study measures were compared between the IPF cases and the matched controls, and the differences were assessed by statistical hypothesis testing.
  - The Student’s t-test for continuous variables, the chi-square test for categorical variables, and the non-parametric Wilcoxon rank sum test for cost and costs variables.

- Contribution to the total medical costs from different healthcare settings was reported.

### RESULTS

#### Pre-index vs. Post-index HRU and Costs

- Inpatient services accounted for half of the medical costs in IPF patients, and these costs doubled in the post-index period. This reflects the poor prognosis of IPF and the fact that it may recur after transplantation.

- The increased pre-index prevalence of comorbidities suggests that comorbidity is an important contributor to the increased HRU and cost associated with an IPF diagnosis. A structured, comprehensive, multidisciplinary approach is likely needed.

- The case definition used to identify IPF patients in this study is not validated against medical charts.

- This population of patients excludes patients with IPF younger than age 65.

- Outpatient medications covered by Medicare Part D plans and out-of-pocket patients for costs were not captured.

- Costs associated with lung transplantation, which is performed mainly on patients younger than 40 years, are not accurately represented in this elderly population.

- The study shares common limitations of retrospective studies using claims data, such as claims under-ascertainment of patients and bias due to undiagnosed confounders.

### LIMITATIONS

- The economic burden (HRU and costs) associated with IPF in the Medicare population is substantial, and those costs will only increase as the population of older Americans with Medicare benefits for IPF grows.

- Payers and other stakeholders in the care of patients with IPF should consider resources to understanding the care patterns that drive these increased costs and developing novel treatments for IPF.

### CONCLUSIONS

- Patients with IPF have increased healthcare utilization compared to demographically matched controls with at least one substantial cost-to-payors before and after the first diagnosis.

- Results from this study complement a previous study performed using private, employer-based claims data reporting qualitatively similar HRU and cost for IPF patients, which validate the findings and strengthen policy implications since Medicare data are more broadly representative of older Americans.

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**DISCUSSION**

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**REFERENCES**

- **Shi,Yin Chen, PHD; Harold R. Collard, MD; Wei-Shih Yeh, PHD; Qian Li, PHD; Yue-Chi Lee, MS; Aan Wang, BS; Ganesh Raghu, MD; Bogdon Ideo, Cambridge, MA; University of California San Francisco, San Francisco, CA; Eviera, Lexington, MA; University of Washington, Seattle, WA.**

- **An Analysis of US Medicare Beneficiaries: Burden of Direct Medical Costs in Patients with Idiopathic Pulmonary Fibrosis**

- **Statistical Analysis**

- **Methodology**

- **Data Sources**

- **Patient Cohort Identification**

- **Statistical Analysis**

- **RESULTS**

- **DISCUSSION**

- **LIMITATIONS**

- **CONCLUSIONS**

**Table 1. Demographics of Incident IPF Cases and Matched Controls**

<table>
<thead>
<tr>
<th>IPF Cases</th>
<th>Matched Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>70.1 (6.9)</td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>91.5</td>
</tr>
<tr>
<td>Black</td>
<td>7.1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.3</td>
</tr>
<tr>
<td>Other</td>
<td>0.1</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>46.4</td>
</tr>
<tr>
<td>Female</td>
<td>53.6</td>
</tr>
</tbody>
</table>

**Figure 2. Pre-index Risk of Comorbidities**

**Figure 3. Pre- and Post-index Annual Healthcare Resource Utilization**

**Figure 4. Average Total Medical Costs and Distribution by Setting**

**Figure 5. Sample Selection**

**Table 2. Proportion of Patients With Proportion of Patients With**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Pre-index</th>
<th>Post-index</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>41.0%</td>
<td>41.0%</td>
</tr>
<tr>
<td>Physician office + outpatient hospital</td>
<td>39.6%</td>
<td>39.6%</td>
</tr>
<tr>
<td>Inpatient</td>
<td>11.9%</td>
<td>11.9%</td>
</tr>
<tr>
<td>Emergency room</td>
<td>8.6%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Skilled nursing facility + hospice</td>
<td>50.0%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

**Disclosure**

Qian Li is an employee of Evidera, and Yuan-Chi Lee was an employee of Evidera at the time the research was conducted. Evidera provides consulting and other research services to pharmaceutical, device, government, and non-government organizations. In their salaried positions, employees of Evidera work with a wider range of organizations. Employment at Evidera is not a conflict of interest, as the work performed is consistent with the company’s standard work used by employees. Employment at Evidera is neither a disqualification nor a conflict of interest.