BACKGROUND

- Carcinoid syndrome (CS) describes the hormonal effects of carcinoid tumors, including the secretion of serotonin into the systemic circulation causing episodic flushing and diarrhea.²
- CS patients with non-infectious diarrhea (NID), one of the most common symptoms of CS, experience profoundly poor sense of well-being.³
- Despite the frequent occurrence of this burdensome CS-related symptom, the healthcare costs and utilization associated with NID has not been elucidated.

OBJECTIVE

- To compare annual health care costs and resource utilization among CS patients with and without NID.

METHODS

Study Design and Data Source

- Retrospective cross-sectional study using the HIPAA-compliant Truven Health Analytics MarketScan® Database from 1/1/2002 to 12/31/2012.

Patient Population

- Patients newly diagnosed with CS: 2,822 patients identified between 1/1/2003 – 12/31/2011 (ID period) based on the following criteria:
  - 1) had ≥1 claim for CS (ICD-9-CM code 259.2), and
  - 2) ≥1 claim for either CS or carcinoid tumors (209.x).

Inclusion Criteria:

- 1) had ≥1 claim for CS (ICD-9-CM code 259.2), and
- 2) ≥1 claim for either CS or carcinoid tumors (209.x).

Exclusion Criteria:

- 1) had CS in the pre-index period, or
- 2) were not continuously enrolled one year before and one year after the index date.

Stratification:

- CS patients were stratified into those with NID vs. those without NID.
- NID patients had ICD-9-CM code 564.5 or 787.91 within 1 year after CS diagnosis.

Data

- All claims in the year pre-index were used to determine patient demographics, number of chronic conditions, and Charlson comorbidity index (CCI).³
- All claims occurring in the 1 year post-index were used to determine the outcome measures of healthcare resource utilization (HRU) and costs.

Statistical Analysis

- Multivariable models were used to adjust outcomes for age, gender, region, number of chronic conditions, and Charlson comorbidity index using SAS® version 9.4.

RESULTS

- Of 2,822 newly-diagnosed CS patients, the mean age was 51.5 years, 56.9% were women, and the mean Charlson Comorbidity Index was 3.6.

- Unadjusted and adjusted HRU and costs were statistically significantly higher in patients with NID vs. those without NID, except for adjusted ED costs.
- After adjusting for baseline differences between groups, patients with NID had higher mean number of office visits, inpatient hospitalizations, and emergency department (ED) visits (all p<0.001) one year post CS diagnosis.

Table 1. Patient Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>With NID</th>
<th>Without NID</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>51.3 (9.9)</td>
<td>51.6 (10.1)</td>
<td>0.639</td>
</tr>
<tr>
<td>Female, %</td>
<td>333 (62.4)</td>
<td>1,273 (55.6)</td>
<td>0.005</td>
</tr>
<tr>
<td>Charlson comorbidity index, mean (SD)</td>
<td>3.7 (3.9)</td>
<td>3.6 (3.8)</td>
<td>0.643</td>
</tr>
<tr>
<td>No. of chronic conditions, mean (SD)</td>
<td>4.0 (2.4)</td>
<td>3.4 (2.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

- Adjusted Mean / Rate (95% CI)

Table 2. Adjusted¹ HRU Means and Rates with 95% Confidence Intervals (CIs)

Outcome | Adjusted Mean / Rate (95% CI)
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number of office visits</td>
<td>24.2 (22.9 - 25.5)</td>
</tr>
<tr>
<td>Number of hospitalizations</td>
<td>0.97 (0.86 - 1.10)</td>
</tr>
<tr>
<td>Number of ED visits</td>
<td>0.67 (0.56 - 0.81)</td>
</tr>
<tr>
<td>Risk of hospitalization</td>
<td>49.4% (45.1% - 53.6%)</td>
</tr>
<tr>
<td>Risk of ED visit</td>
<td>36.2% (32.2% - 40.5%)</td>
</tr>
</tbody>
</table>

- Adjusted by age, gender, region, number of chronic conditions, and CCI.
- All adjusted HRU mean and rate comparisons had a p<0.001.
- Patients with NID had higher adjusted total annual costs: (+$29,890), pharmacy costs (+$2,557), non-pharmacy costs (+$27,334), visit costs (+$16,695), and inpatient hospitalization costs (+$11,431) compared to those without NID (all p<0.001).
- Adjusted ED costs were similar: $1864 in CS patients with NID vs. $1616 in those without NID (p=0.5).

LIMITATIONS

- We attributed all NID diagnoses to CS but we mitigated the possibility of misdiagnosis by excluding certain ICD-9 CM codes (e.g., gastrointestinal [558.9]). Our patient identification algorithm allowed a relatively long interval to pass between the first and confirmatory diagnosis. This may have reduced the specificity of our algorithm but should have affected both groups equally.
- We adjusted for a variety of potential confounders but not for pre-diagnosis HRU or cost since we only examined newly diagnosed patients in whom controlling for pre-diagnosis resource use would be of limited value.
- Our results are only generalizable to the US commercially-insured population.

CONCLUSIONS

- Our annual prevalence estimate of diarrhea (18.9%) was similar to a published estimate of 17.6% in NET patients in which the majority had CS (72%).⁴
- NID in CS patients is associated with a significantly increased annual healthcare utilization and an additional $30,000 in total annual healthcare costs, which predominately comprise medical costs.
- The odds of hospitalization among CS patients with NID are about 1.5 times those of those without NID.
- Our study indicates that in cancer patients with CS compared to those without this highly burdensome symptom, diarrhea is a significant problem.
- It is possible that adequate control of diarrhea in CS patients may reduce healthcare costs.

References


Figure. Costs (adjusted for demographics, region, no. of chronic conditions, & CCI)

- Total Healthcare Costs
- Total inpatient hospitalization costs
- Total visit costs
- Total non-pharmacy costs

This study was sponsored by Novartis Pharmaceuticals Corporation.