Validation of an electronic algorithm for Hodgkin and non-Hodgkin Lymphoma in ICD-10-CM

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OBJECTIVE
- Develop and validate an ICD-10-CM-based algorithm to identify lymphoma with a positive predictive value (PPV) of at least 80% (±10%) to support studies of drug safety

BACKGROUND
- >77,000 new non-Hodgkin (NHL) and 8,400 Hodgkin lymphoma (HL) cases diagnosed in the US each year
- More than 60 histologic subtypes of lymphoma
- Lymphoma is generally diagnosed in the outpatient setting with enlarged lymph nodes as the most common symptom
- Most lymphoma cases definitively diagnosed through biopsy or flow cytometry
- Majority of cases will have imaging studies (e.g., CT, MRI, PET scans) to aid in diagnosis and determine extent of disease

METHODS

Data Source and Study Population
- Four Sentinel Data Partners (3 national insurers, 1 integrated healthcare system) contributed data
- Eligible participants were aged ≥15 years and enrolled for ≥12 months before diagnosis

Algorithm Development and Evaluation
- Three component algorithm: 2 lymphoma-related diagnosis codes within 183 days, ≥1 diagnostic procedure code and ≥1 relevant imaging code ± 90 days from first diagnosis (Figure 1)
- De-identified, patient-level claims data were extracted for 211 of the 8723 patients identified by the algorithm and reviewed by two oncologists to select encounters for chart retrieval
- 134 full charts from algorithm-positive cases were abstracted and adjudicated with data from -30 to +90 days from selected encounter date
-_subtype data (NHL vs HL) explored
- Definite and Probable cases considered true positives for calculation of the Positive Predictive Value (PPV)

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- The views expressed are those of the authors and are not to be construed as conveying either an official endorsement or criticism by U.S. Department of Health and Human Services, or U.S. Food and Drug Administration.
- Many thanks are due to Data Partners who provided data used in the analysis.

RESULTS

1) Design Diagram
- Index: first diagnosis date of NHL or HL
- Enrollment: medical and pharmacy coverage [-365, 0]
- Incidence criterion: no diagnosis codes for NHL or HL [-365, -1]
- ≥2 ICD-10-CM diagnosis codes for NHL or HL [0, 183]
- ≥1 diagnostic procedure code (e.g., biopsy, flow cytometry) [-90, 90]
- ≥1 procedure code for an imaging study (e.g., CT of chest, abdomen and pelvis; CT of neck; PET-CT; MRI of brain) [-90, 90]

2) Chart Adjudication Results (N = 134)
- Definite: 61 (46%)
- Probable: 42 (31%)
- Possible: 8 (6%)
- Other condition: 8 (6%)
- No evidence: 15 (11%)

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Overall</th>
<th>Definite</th>
<th>Probable</th>
<th>Possible</th>
<th>No evidence</th>
<th>Other condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>62.2</td>
<td>62.4</td>
<td>63.7</td>
<td>70</td>
<td>52.6</td>
<td>58.1</td>
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<tr>
<td>Median</td>
<td>65.5</td>
<td>65</td>
<td>66.5</td>
<td>67.5</td>
<td>62</td>
<td>66</td>
</tr>
<tr>
<td>Range</td>
<td>17-94</td>
<td>21-85</td>
<td>17-83</td>
<td>49-94</td>
<td>18-79</td>
<td>18-90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex, N (%)</th>
<th>Overall</th>
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<th>Probable</th>
<th>Possible</th>
<th>No evidence</th>
<th>Other condition</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>69 (52%)</td>
<td>36 (59%)</td>
<td>21 (50%)</td>
<td>4 (60%)</td>
<td>0</td>
<td>8 (53%)</td>
</tr>
<tr>
<td>Female</td>
<td>64 (48%)</td>
<td>25 (41%)</td>
<td>20 (48%)</td>
<td>4 (60%)</td>
<td>8 (100%)</td>
<td>7 (47%)</td>
</tr>
<tr>
<td>Missing</td>
<td>1 (&lt;1%)</td>
<td>0</td>
<td>1 (2%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

3) Demographic Characteristics by Chart Adjudication Status

<table>
<thead>
<tr>
<th>Subtype</th>
<th>NHL (69%)</th>
<th>HL (8%)</th>
<th>Non-case (23%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite</td>
<td>92</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>Probable</td>
<td>37</td>
<td>40</td>
<td>73</td>
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<tr>
<td>Possible</td>
<td>54</td>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>

DISCUSSION

Strengths
- This project updates prior Sentinel work to develop an algorithm using ICD-10 codes
- Inclusion of data from both national insurers and an integrated delivery system enhanced generalizability of the results

Limitations
- Chart reviews limited to one encounter
- Future iterations may add steps to further rule out non-lymphoma malignancies

Conclusions
- An ICD-10-based algorithm including both diagnosis and procedure codes can identify lymphoma cases from health claims data with reasonable accuracy
- Subtype (NHL or HL) correctly determined for most cases

11% Likely
6% Possible
6% Probable lymphoma
46% Definite lymphoma
95% CI: 69-84%

Cases judged as definite or probable lymphoma were considered true positives. Other conditions (N=15) included other cancers (80%) and non-malignant conditions (20%).