Introduction

The International Classification of Diseases was revised in 2015 from International Classification of Diseases, Ninth Revision (ICD-9) to International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10), representing the largest revision to the system in 30 years (from 14,500 to 70,000 codes). Although ICD-10 could document conditions with greater granularity, it remains to be seen whether it has been well-utilized up to the 2022 transition to International Classification of Diseases, 11th Revision (ICD-11).

With ICD-10, the number of inflammatory arthritis codes increased from 14 to 425. Although this allows for better characterization of such conditions for more than 1.3 million affected US individuals, the greater granularity is useful only if the breadth of codes is utilized. The purpose of this quality improvement study was to investigate usage patterns of inflammatory arthritis codes under ICD-10 vs ICD-9.

Methods

M151Ortho is a national multi-insurance administrative claims data set by Pearldiver Technologies that was used to identify patients with inflammatory arthritis with ICD-9 and ICD-10 codes. Because Pearldiver data are deidentified, the Yale University institutional review board deemed that this quality improvement study did not meet the federal definition of research and did not require approval or informed consent, in accordance with 45 CFR §46. This report follows STROBE reporting guidelines. ICD-9 inflammatory arthritis codes include 714.0X to 714.9X (14 codes). ICD-10 codes include M05.XXX, M06.XXX, M08.XXX, and M12.00X-M12.09X (438 codes). If a patient had multiple encounters, the earliest encounter was used.

Patients with ICD-10 codes were grouped by year from 2015 to 2021 and by clinician specialty code. Clinicians were categorized as primary care physicians, rheumatologists, orthopedic surgeons, and other physicians.

Distributions of code utilization were compared between year-by-year subgroups and clinician-by-clinician subgroups. χ² and 2-sample Kolmogorov tests were performed using Bellwether software version 2.1 (Pearldiver) and R software version 4.3.0 (R Project for Statistical Computing). Significance was set at 2-tailed α = .05.

Results

In total, 5,152,250 patients (3,817,817 female [74.1%]; mean [SD] age, 58.2 [16.4] years) with inflammatory arthritis were identified. 2,626,584 (51.0%) were coded in ICD-9 and 2,525,666 (49.0%) in ICD-10. For ICD-9, 4 of 14 inflammatory arthritis codes (28.6% of available codes) were higher-usage codes (used >1% of the time). For ICD-10, 9 of 438 codes (2.1%) were higher-usage (Table). Of the top 20 codes, 65% contained unspecified or other specified in the verbiage.

To assess for a learning curve in ICD-10 usage, year-by-year subgroups were tabulated for number and percentage of higher-usage codes (Figure). There was no significant change from year to year.
To assess usage of ICD-10 across specialties, clinician subgroups were assessed for number of higher-usage codes: 9 codes (2.1%) for primary care, 8 (2.1%) for rheumatology, 2 (0.5%) for orthopedics, and 6 (1.4%) for other specialties. There were no differences between primary care physicians, rheumatologists, and other physicians, whereas orthopedists used significantly fewer codes.

Discussion

The transition to ICD-10 afforded the potential of increased granularity of inflammatory arthropides diagnosis codes for clinical care, research, and billing purposes. This quality improvement study found that, despite a 30-fold increase in codes, adoption of ICD-10 has been poor; only 2.1% of available codes were used more than 1% of the time and were nonspecific. This may reflect the lack of financial incentive for accurate ICD-10 coding, because ICD-10 is not tied to reimbursement.

Table. Top 10 ICD-9 and ICD-10 Codes for Inflammatory Arthritides by Usage

<table>
<thead>
<tr>
<th>Rank</th>
<th>ICD-9 (n = 2,626,584 patients)</th>
<th>ICD-10 (n = 2,525,666 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Code name</td>
<td>Patients, No. (%)</td>
</tr>
<tr>
<td>1</td>
<td>714.0 Rheumatoid arthritis</td>
<td>2,000,071 (76.1)</td>
</tr>
<tr>
<td>2</td>
<td>714.9 Unspecified inflammatory polyarthritis</td>
<td>500,424 (19.1)</td>
</tr>
<tr>
<td>3</td>
<td>714.89 Other specified inflammatory polyarthropathies</td>
<td>47,208 (1.8)</td>
</tr>
<tr>
<td>4</td>
<td>714.30 Polyarticular juvenile rheumatoid arthritis chronic or unspecified</td>
<td>38,750 (1.5)</td>
</tr>
<tr>
<td>5</td>
<td>714.2 Other rheumatoid arthritis with visceral or systemic involvement</td>
<td>12,242 (0.5)</td>
</tr>
<tr>
<td>6</td>
<td>714.4 Chronic postrheumatic arthropathy</td>
<td>64,445 (0.3)</td>
</tr>
<tr>
<td>7</td>
<td>714.32 Pauciarticular juvenile rheumatoid arthritis</td>
<td>54,231 (0.2)</td>
</tr>
<tr>
<td>8</td>
<td>714.1 Felty’s syndrome</td>
<td>48,111 (0.2)</td>
</tr>
<tr>
<td>9</td>
<td>714.81 Rheumatoid lung</td>
<td>43,982 (0.2)</td>
</tr>
<tr>
<td>10</td>
<td>714.31 Polyarticular juvenile rheumatoid arthritis acute</td>
<td>18,244 (0.0)</td>
</tr>
</tbody>
</table>


Figure. Higher vs Lower Usage International Classification of Diseases, Ninth Revision, ICD-10, International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) Codes

Graphs show higher usage codes, defined as those accounting for >1% (A), and lower usage codes, defined as those accounting for <1% of patients (B), presented in total and by year following the introduction of ICD-10. In panel A, there were 9 codes (2.1%) each for 2015, 2016, and 2017, 7 (1.6%) each for 2018 and 2019, and 6 (1.4%) each for 2020 and 2021. There was no statistically significant change in utilization of higher-usage codes from one year to the next following the introduction of ICD-10 (P = .94).
When assessed by year, the percentage of codes used with regularity did not increase. When assessed by clinician specialty, the percentage of codes used was not better for rheumatologists (who might be expected to be more refined users of such codes) than primary care clinicians. This study is limited by potential coding inaccuracies and cannot establish causality.

Overall, consistent with findings in other areas, \textsuperscript{5,6} the data suggest room for better application of inflammatory arthritis codes. This will be important in years to come if the benefits of ICD expansion are to be realized.

**ARTICLE INFORMATION**

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Author Contributions: Mr Zhu and Dr Grauer had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: All authors.

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Drafting of the manuscript: Zhu, Gouzoulis, Kammien, Grauer.

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Administrative, technical, or material support: Galivanche, Gillinov.

Supervision: Grauer.

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Data Sharing Statement: See the Supplement.

Additional Information: All codes used were either from preexisting codes from the PearlDiver software or custom-made directly in the software. Codes are available on request.

**REFERENCES**


SUPPLEMENT.
Data Sharing Statement