Enhanced Cost-Effectiveness Analysis using EHR Data for Real-World Value

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Motivation

- Health technology assessments for new therapies must rely on data from clinical trials.
- As these therapies are used in clinical practice, new evidence in the form of real-world data can supplement findings from initial health technology assessments.
- Real-world evidence (RWE) generated from electronic health records (EHR) has been shown to be more relevant, timely, and representative for health technology assessment decision-making compared to evidence from clinical trials.

Approach

- We replicated a cost-effectiveness analysis of NSCLC therapies developed by the Institute for Clinical and Economic Review in 2016 (“traditional”), replacing meta-analysis-derived hazard ratios and survival times from clinical trials with RWE-derived hazard ratios for progression-free and overall survival (“RWE-enhanced”).
Figure 1. Patient selection

*Patients who received pembrolizumab or atezolizumab were required to be positive for PD-L1
Clinical trials: POPLAR for atezolizumab, CheckMate 017 for nivolumab, and KEYNOTE-010 for pembrolizumab.

*Data not reported in trial publication
Figure 3. Results

Simulated ICERs resulting from probabilistic sensitivity analyses comparing atezolizumab, nivolumab and pembrolizumab to chemotherapy. The dashed reference line indicates an ICER of $100,000/QALY.

Compared to uncertainty intervals reported for traditionally-calculated ICERs, the RWE-enhanced ICER 95% CrIs were reduced by 37%, 69%, and 83% for atezolizumab, nivolumab, and pembrolizumab respectively.

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Traditional ICER ($/QALY) [95% CrI]</th>
<th>RWE-enhanced ICER ($/QALY) [95% CrI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>atezolizumab</td>
<td>84,000 [2,000-776,000]</td>
<td>138,000 [59,000-548,000]</td>
</tr>
<tr>
<td>nivolumab</td>
<td>136,000 [47,000-379,000]</td>
<td>123,000 [80,000-183,000]</td>
</tr>
<tr>
<td>pembrolizumab</td>
<td>181,000 [53,000-527,000]</td>
<td>110,890 [76,000-156,000]</td>
</tr>
</tbody>
</table>
Conclusions

- This proof-of-concept demonstrated how clinical depth, longer follow-up time, and larger sample sizes in EHR-derived data may reduce uncertainty in cost-effectiveness analysis.
- The approach has potential to inform dynamic value-based pricing and highlights the importance of reassessments once RWE is available.
- Future studies could explore the opportunity to inform patient-level microsimulation models with EHR-derived data.

Limitations

- Sample size in the three immunotherapy cohorts varied based on how many patients received each therapy in the Flatiron Health database. RWE-enhanced cost effectiveness analysis is best suited for therapies with high uptake in real-world populations.
- For the purposes of this analysis, only the inclusion criteria listed in Figure 1 were implemented; clinical trial criteria involving other variables (ex. Baseline ECOG, sites of metastasis) were not implemented.
- Population adjustment methods such as matching were not applied to the real-world dataset. Bias-variance trade-offs should be considered before applying matching.