The role of economic modeling for study design and implementation

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Objectives

• Briefly describe economic modeling and its strengths and weaknesses
• Discuss potential applications for study design and implementation
• Present successful examples of application of modeling in genomics
What is economic modeling (add definition)

• In economics, a model is a theoretical construct representing economic processes by a set of variables and a set of logical and/or quantitative relationships between them. The economic model is a simplified framework designed to illustrate complex processes, often but not always using mathematical techniques.
Strengths and Weaknesses

- Doesn’t require complete data
- Helps to identify which data elements are the most important to collect
- Can be run from different stakeholder perspectives

- Very sensitive to assumptions
- Rigorous modeling is very complex, resource intensive requiring significant expertise and experience
- To reflect the ‘real world’ models can become unmanageable
Examples (references at end)

• The health system perspective
  o Universal Lynch syndrome screening

• Hypothetical analysis to facilitate future decision making
  o *IL28B* testing to inform use of protease inhibitor in Hepatitis C viral genotypes 2 and 3

• Patient perspective
  o Pharmacogenomic testing to inform warfarin dosing

• Generic approaches to modeling
  o HLA-B*15:02 and carbamazepine
  o Lynch syndrome
Universal Lynch syndrome screening
Comparison of Models

<table>
<thead>
<tr>
<th>protocol</th>
<th>100 CRC cases</th>
<th>total cost to test</th>
<th>incremental increase in cost</th>
<th># LS cases found</th>
<th>increase in cases found versus protocol above</th>
<th>average cost per case detected</th>
<th>cost to find additional case of LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHC with BRAF and Methylation</td>
<td>$35,203</td>
<td>--</td>
<td>3.28</td>
<td>--</td>
<td>$10,730</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>IHC with Methylation (no BRAF)</td>
<td>$37,369</td>
<td>$2,166</td>
<td>3.29</td>
<td>0.0076</td>
<td>$11,363</td>
<td>285,807</td>
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<tr>
<td>IHC with BRAF (no Methylation)</td>
<td>$38,338</td>
<td>$969</td>
<td>3.34</td>
<td>0.0512</td>
<td>$11,481</td>
<td>$19,056</td>
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<tr>
<td>IHC straight to Sequencing</td>
<td>$44,652</td>
<td>$6,313</td>
<td>3.35</td>
<td>0.0039</td>
<td>$13,355</td>
<td>$1,604,113</td>
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</tbody>
</table>
IL28B and Protease inhibitors in HCV

- Routinely used in HCV viral genotype 1
  - Economic analyses support cost-effectiveness
- HCV viral genotypes 2 and 3 more responsive to therapy
  - Standard therapy is dual therapy not including PI
- Patient IL28B genotype predicts response to treatment in all HCV viral genotypes
  - Very limited evidence in HCV genotypes 2 and 3
- Questions:
  - Could IL28B genotyping be used to select candidates for use of triple therapy?
  - How much improvement in sustained viral response is needed to cross a threshold of cost effectiveness?
Results

Administering triple therapy to patients with resistant *IL28B* genotype requires an improvement in SVR of slightly greater than 2% to cross cost-effectiveness threshold. Treating all patients requires an improvement of over 11%.
PGX informed Warfarin Dosing and Patient Perspective

• Used prospective trial data from Intermountain Healthcare
• Use a policy model approach to assess cost-effectiveness
• Testing vs. no testing arms essentially equivalent
• Prospective trial data showed that tested patients required 2-3 fewer INRs
• Patient-centered perspective would strongly favor testing based on reduced disruption of patient/family life
Generic Modeling

• Supplement to UF IGNITE grant
  o Modeling cost-effectiveness analysis for pre-emptive genetic testing for a pharmacogenomics adverse event (HLA-B*15:02 and Carbamazepine)
  o International scope
  o Building generic model on the published Thai model.
  o Using data from Singapore and Malaysia to compare results of customized model to generic model
  o Generic model is delivering results that are probably ‘good enough’
  o Manuscript in preparation
Generic Modeling

• Lynch syndrome implementation project
  o Using a business case model developed and tested at Intermountain Healthcare
  o Will populate model with local inputs from several different health care systems
  o Measure the impact of the model results on decision making at the institutional level
  o Proposal in revision for resubmission to NIH D&I study section
Conclusions

• Defining perspective is critically important
• Economic analysis tools can be used pragmatically to rationalize decision-making
• Tough to publish!!
• Just scratching the surface regarding application in genomic medicine
Shameless Plug
References


