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

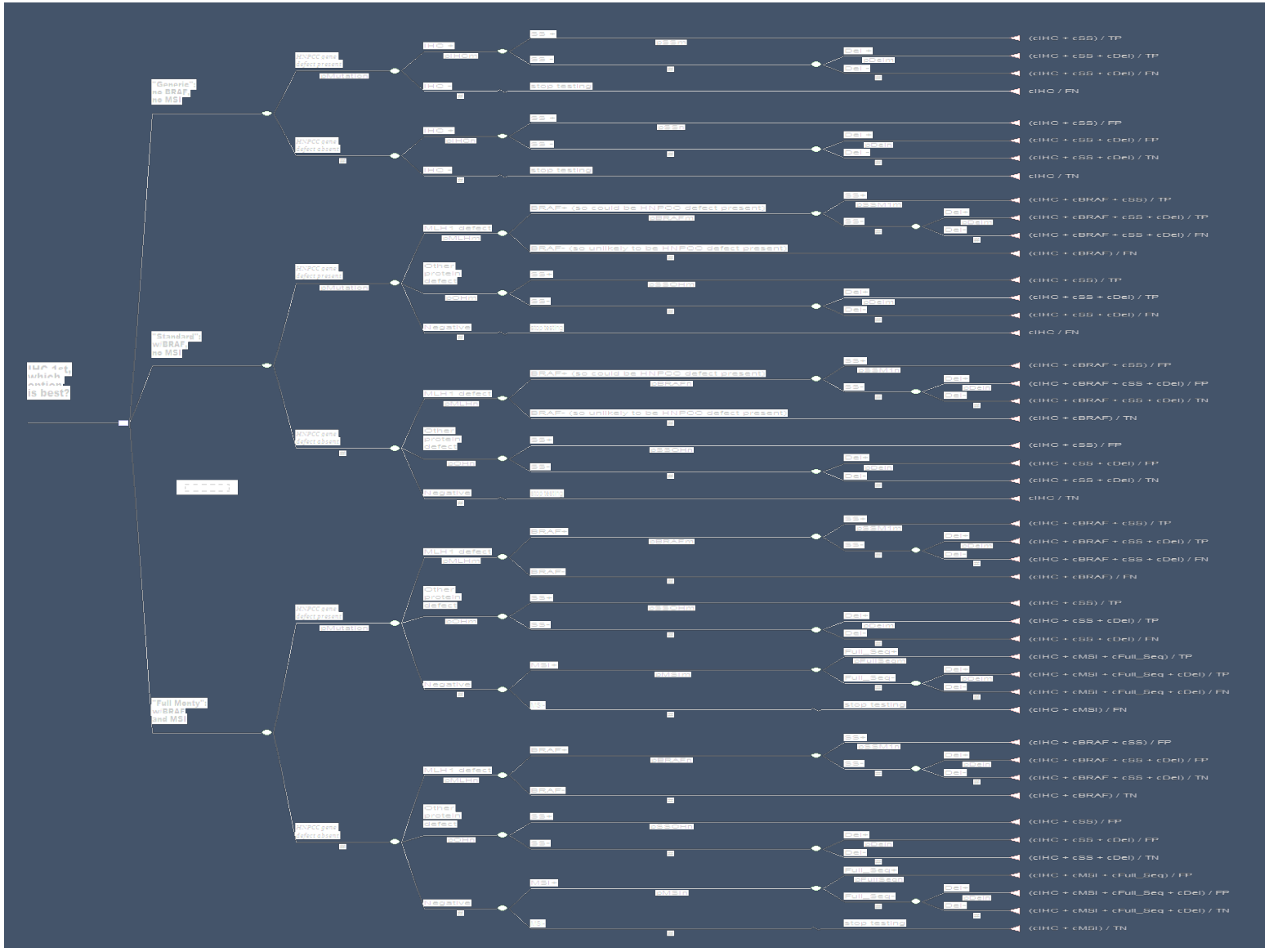
- Doesn’t require complete data
- Helps to identify which data elements are the most important to collect
- Can be run from different stakeholder perspectives

- 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
  - Universal Lynch syndrome screening
- Hypothetical analysis to facilitate future decision making
  - *IL28B* testing to inform use of protease inhibitor in Hepatitis C viral genotypes 2 and 3
- Patient perspective
  - Pharmacogenomic testing to inform warfarin dosing
- Generic approaches to modeling
  - HLA-B*15:02 and carbamazepine
  - Lynch syndrome

Universal Lynch syndrome screening



Comparison of Models

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

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

Ref.	SOC duration, weeks	HCV cohort	Telaprevir recipients	Therapy cost, USD	Cost-effectiveness threshold, SVR rate		Threshold increase from SOC	
					cohort A	cohort B	cohort A	cohort B
[7]	24	Treatment Arm 1	All SNPs	46,294.49	≥94.85	≥97.67	7.91	11.11
[7]	24	Treatment Arm 2	All SNPs	44,334.71	≥80.92	≥83.70	9.06	12.80
[7]	24	Treatment Arm 3	TG/GG (rs8099917) or TT (rs12979860)	27,613.03	≥83.85	≥84.74	2.63	3.72
[14]	12	Treatment Arm 4a	TT (rs12979860)	14,050.81	≥61.71	≥62.02	1.66	2.17
[14]	24	Treatment Arm 5a	TT (rs12979860)	24,529.28	≥79.60	≥80.16	1.40	2.11
[14]	12	Treatment Arm 4b	CT or TT (rs12979860)	24,881.22	≥64.64	≥66.11	6.49	8.91
[14]	24	Treatment Arm 5b	CT or TT (rs12979860)	37,056.93	≥82.82	≥84.74	5.50	7.95

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

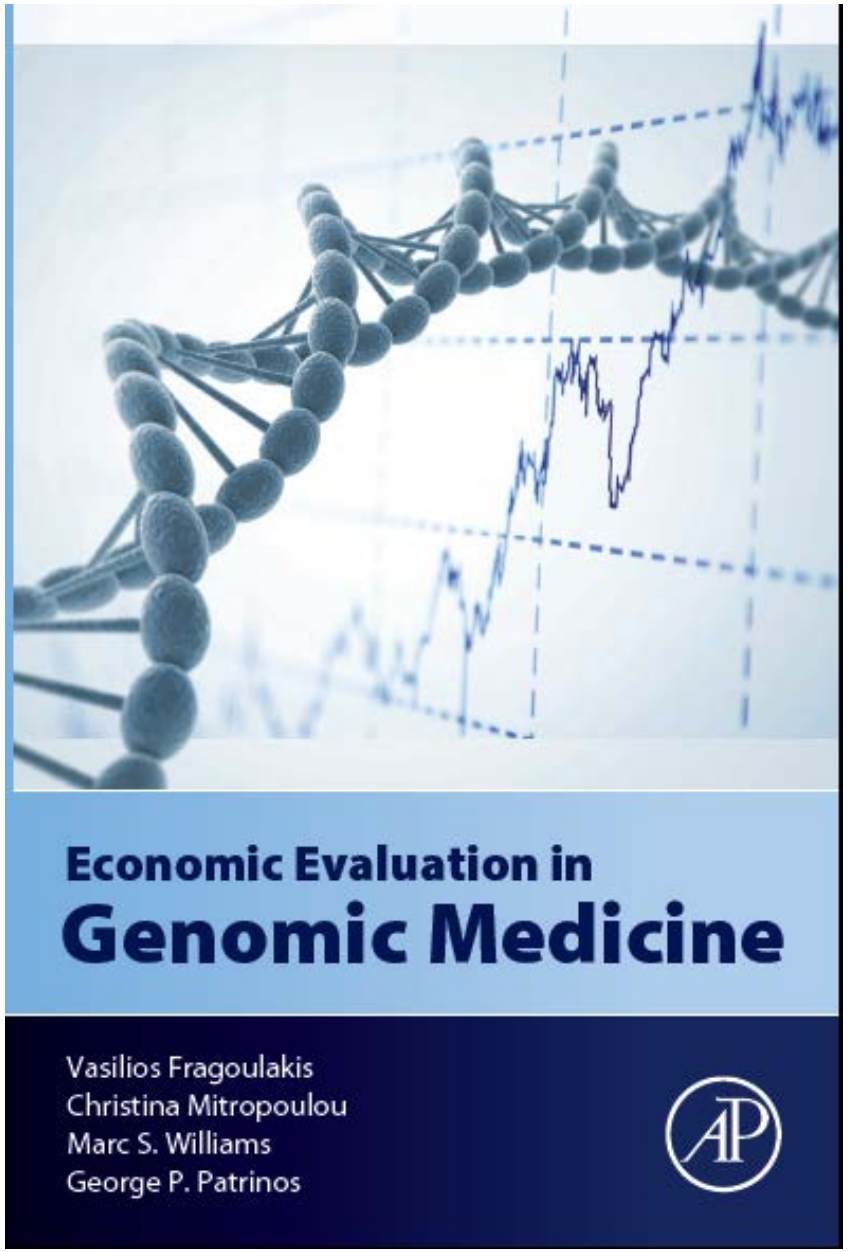
Generic Modeling

- Lynch syndrome implementation project
  - Using a business case model developed and tested at Intermountain Healthcare
  - Will populate model with local inputs from several different health care systems
  - Measure the impact of the model results on decision making at the institutional level
  - 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



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