



Economic Considerations for Implementing Pharmacogenomics

CPIC 2017 Pre-Conference

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What are Economic Considerations?

- Cost of testing
- Cost of returning results
 - Clinical decision support
 - Education
 - Managing data
- Reimbursement
- Savings from improved therapeutic outcomes
- Cost - Effectiveness (CE)

CE – Specific PGx Scenarios

Scenario	ICER (\$/QALY)
HLA-B 1502 -- Antiepileptics in Asian populations	\$7,930 – \$136,630
HLA-B 5701 -- Abacavir	\$36,700
CYP2C19 -- Antiplatelet agents post-PCI	\$30,200
UGT1A1 -- Atazanavir	~\$2,000,000

ICER = Incremental Cost-Effectiveness Ratio

QALY = Quality Adjusted Life Year

Kazi, Ann. Int. Med. 2014

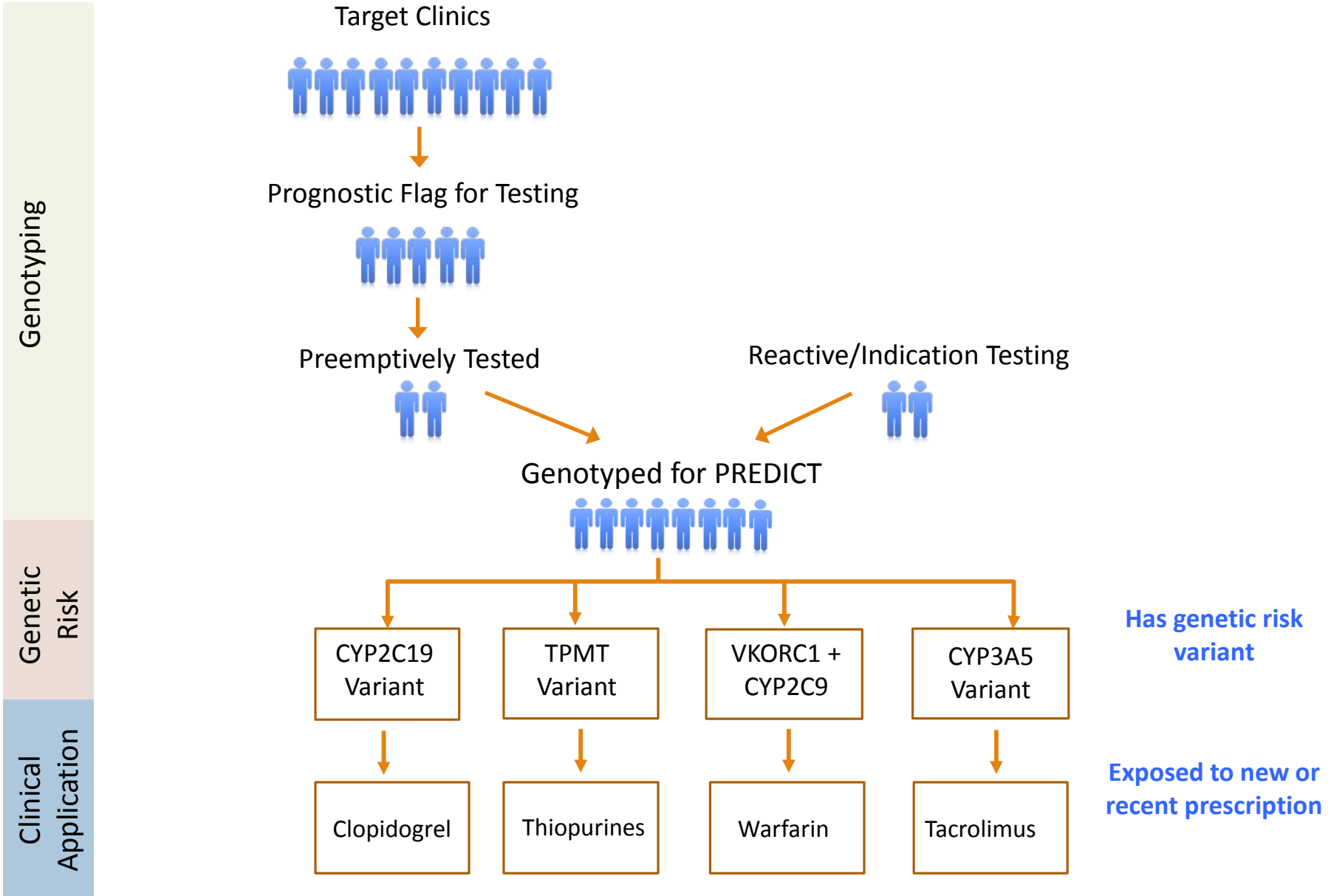
Berm, PLoS One. 2016

CE - Panel Testing

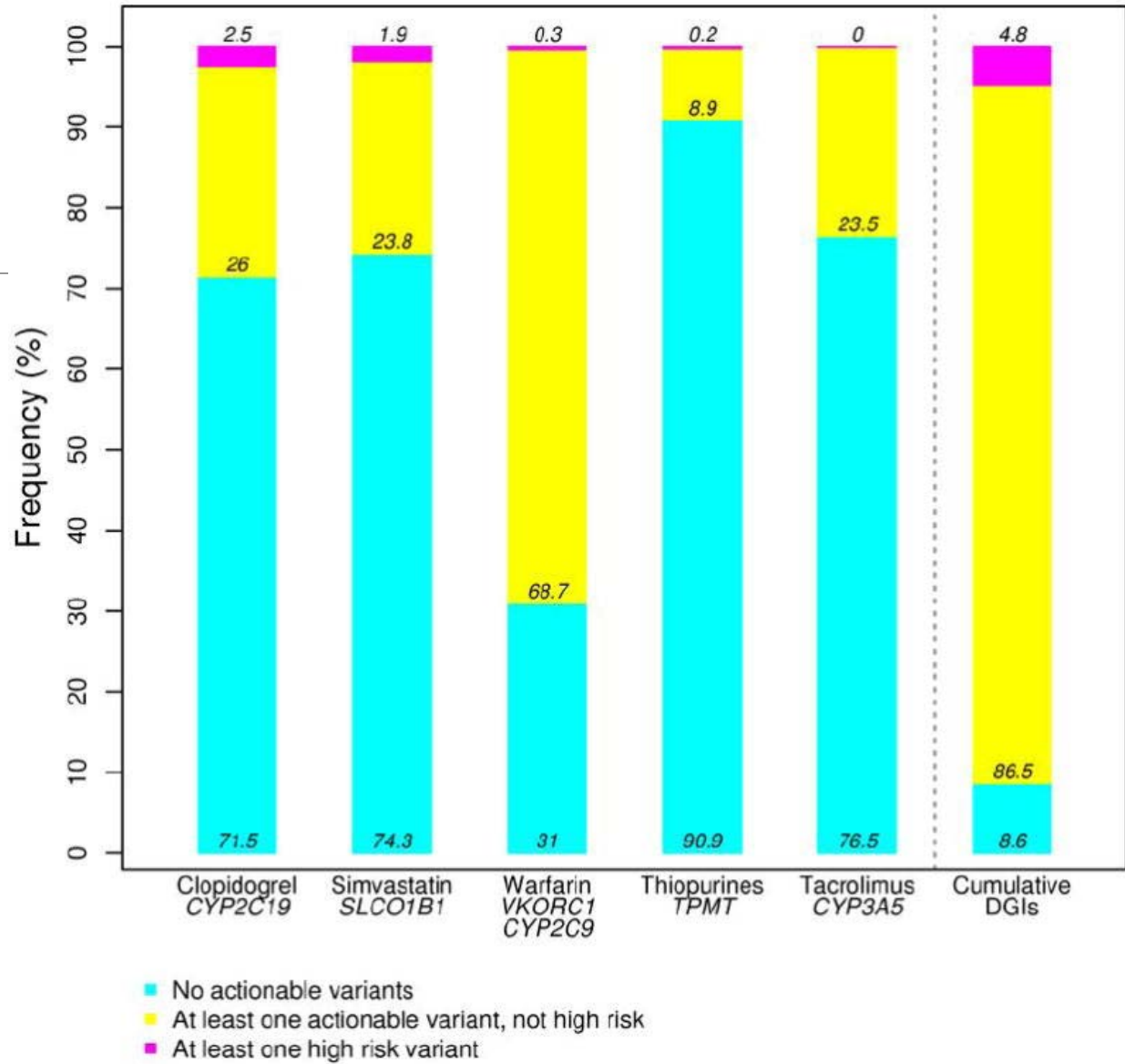
- Economy of scale
 - Broadens the opportunities to perform testing
 - Pre-emptive testing
 - “First Indication” testing
 - Behavior: No need for physicians to remember to order
-

- In most cases, panels cost more
- The information may never be used
- Benefits are accrued in the future

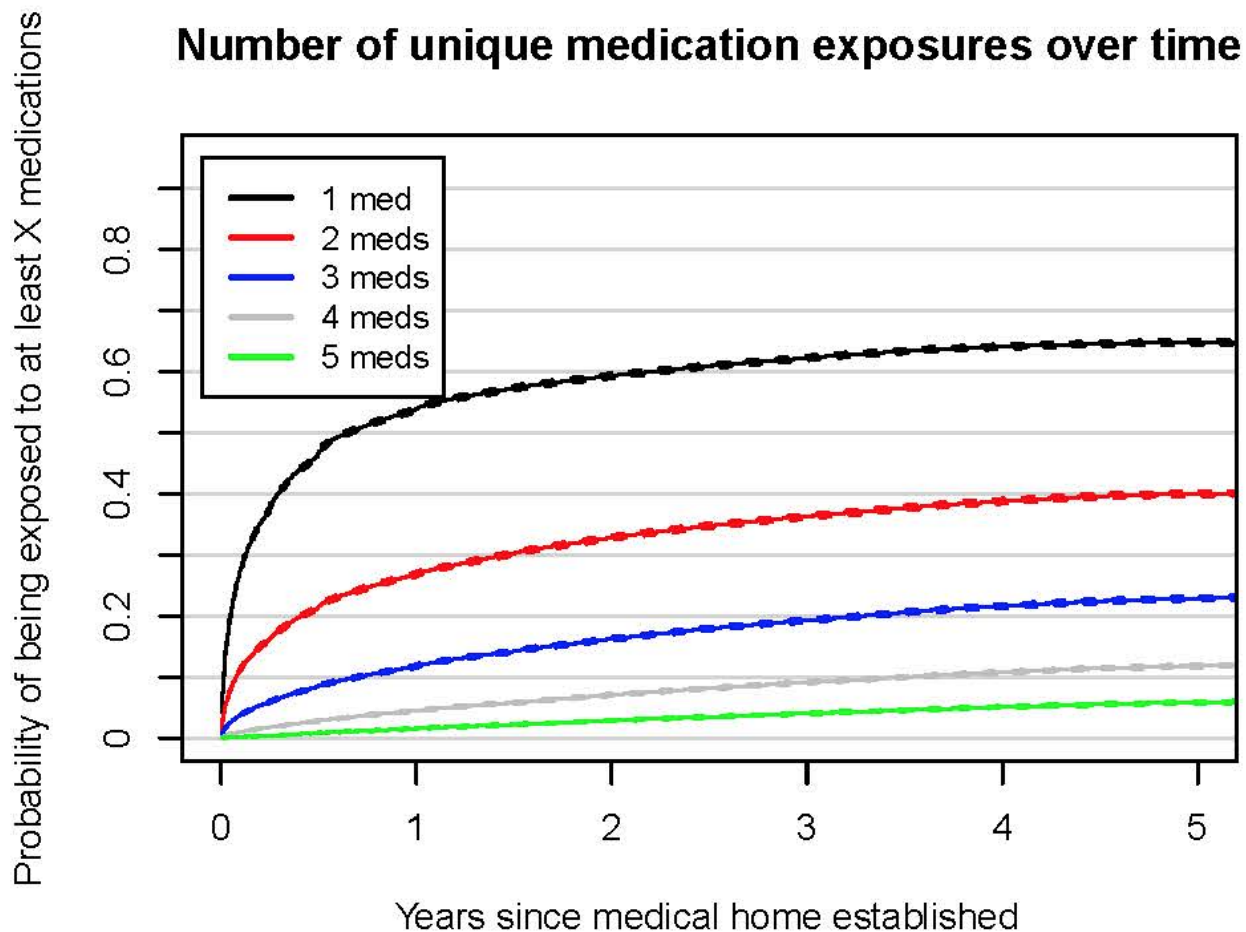
Pharmacogenomics: PREDICT Model



Cumulative PGx Variant Rates

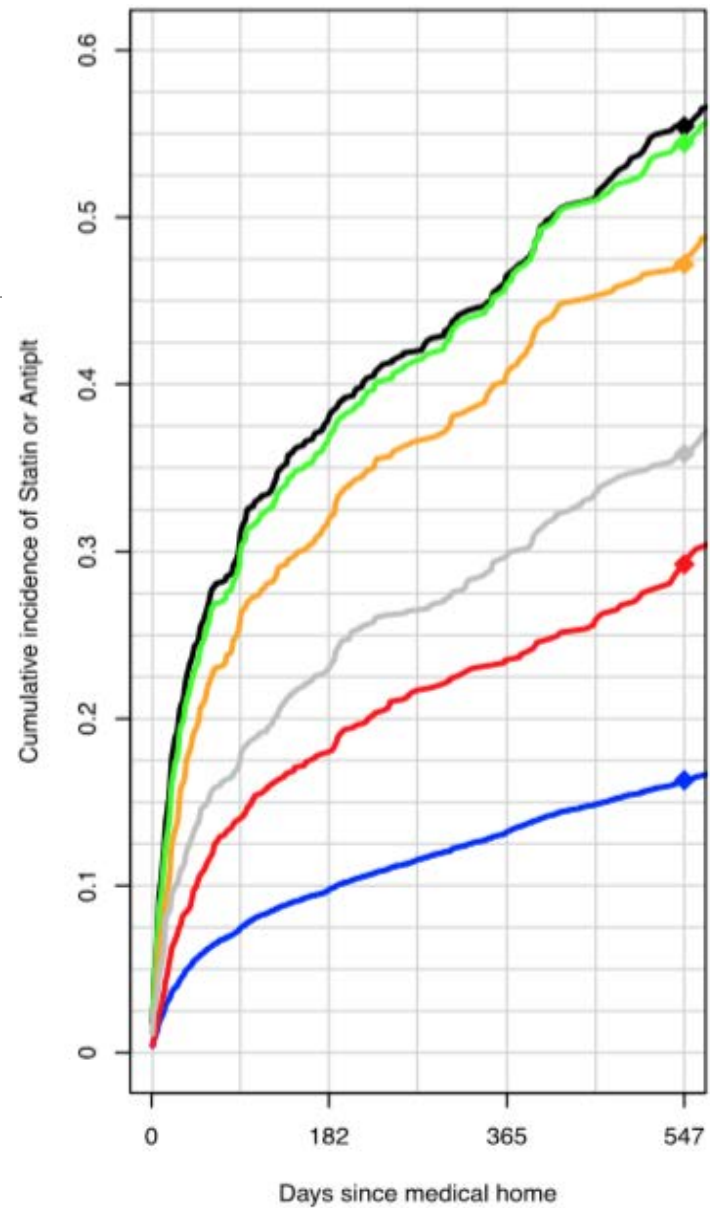
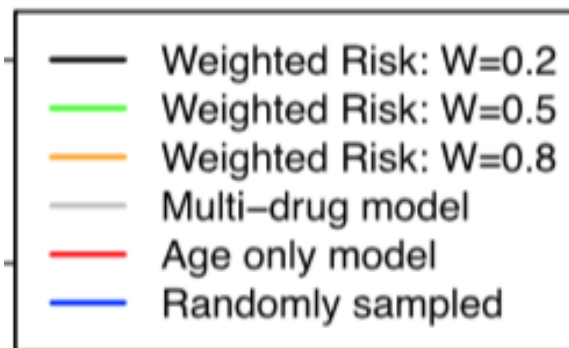


Cumulative Medication Rates



Schildcrout JS, 2012, CPT.

Can Target Patients for Preemptive Genotyping

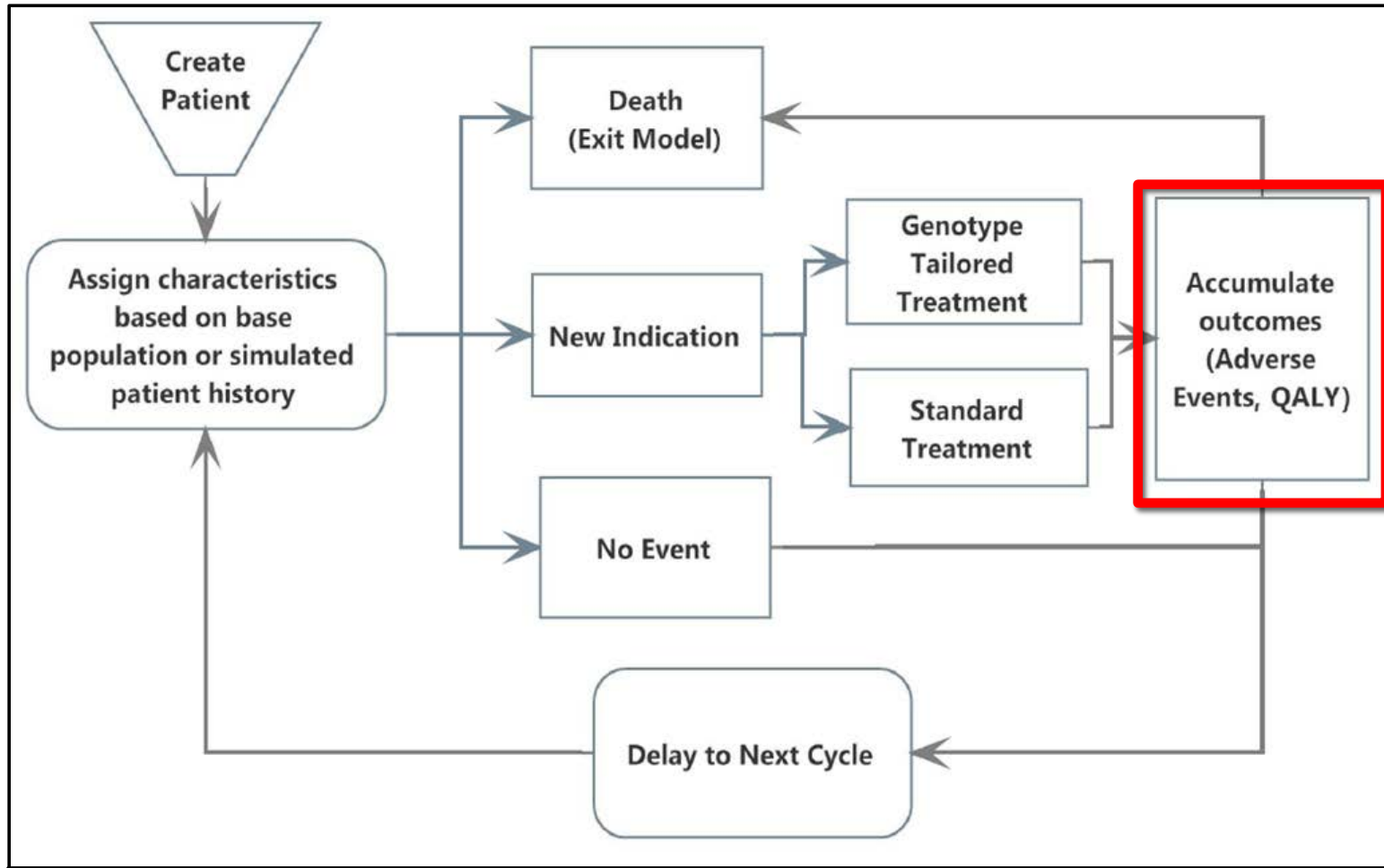


RIGHT Aims

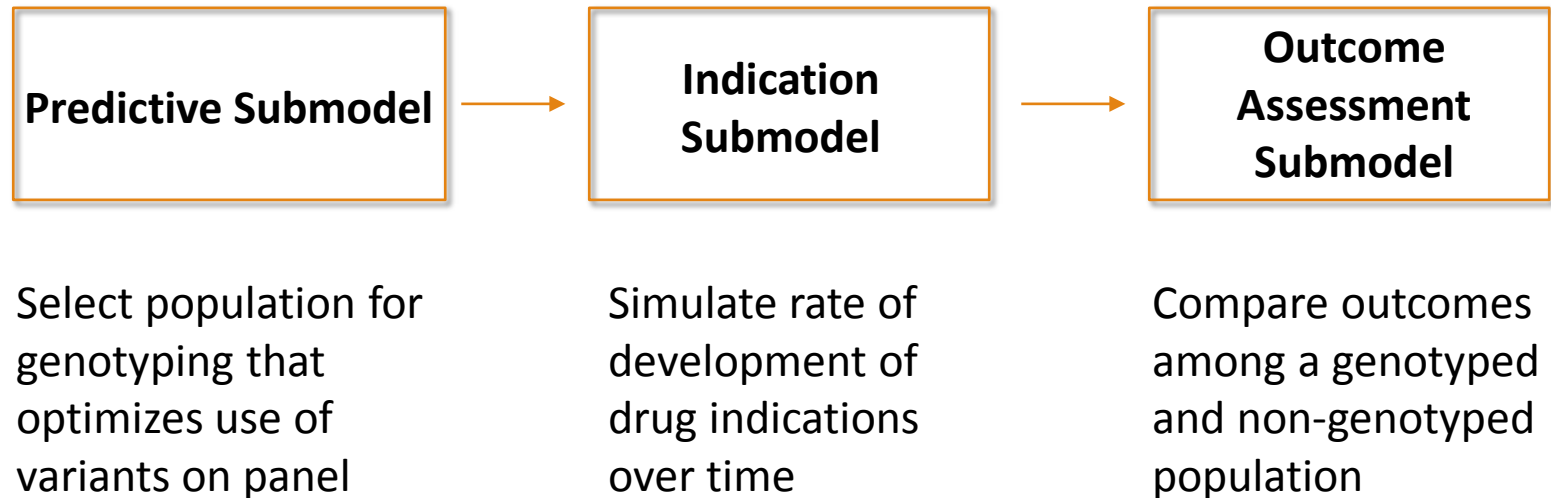


- Compare Genotyping Strategies
 - Base case: No Genotyping
 - Serial Single Gene
 - Universal Preemptive
 - Targeted Preemptive
 - First Indication
- Determine effect of clinician behavior on value of the panel

RIGHT Study: Simulation of Multiplexed Genotyping



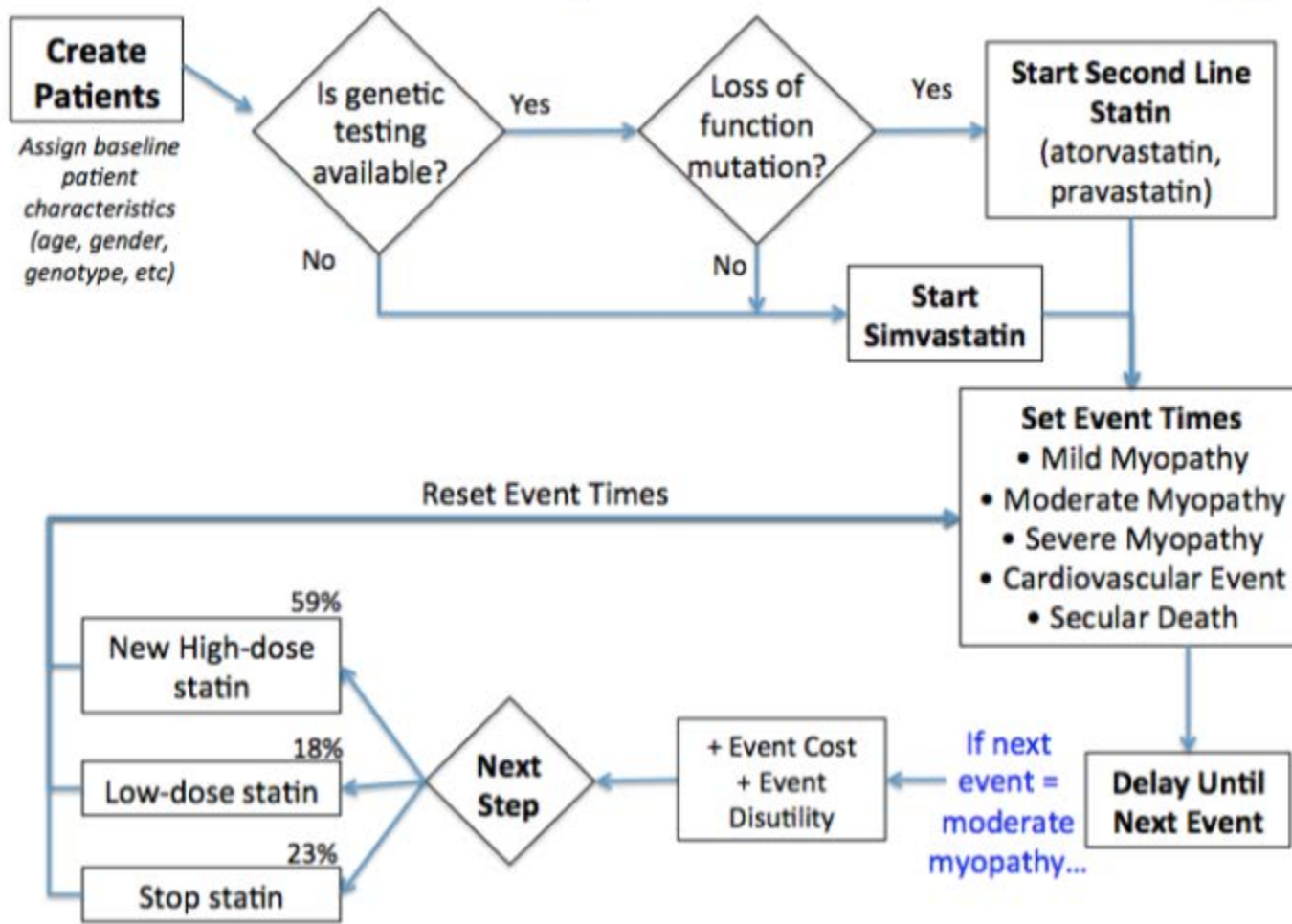
Stages of Simulation



Features of Simulation

- Models the benefits and risks of PGx tailored therapy
 - E.g the risk of bleeding when prescribing a potent alternative antiplatelet agent
- Manages Competing Risks
 - Secular death assumed based on standard life tables
- Individualizes Cardiac Risk to predict timing of cardiac indications
 - Based on Framingham cohort
- Includes behavioral factors
 - Genetic ordering behavior
 - Use of genetic data to tailor prescription

Drug-Specific Simulations: Simvastatin -SLC01B1



Results – Single Drug Models

PGx Scenario	ICER Compared to No Genotyping
Clopidogrel – CYP2C19	\$36,618
Simvastatin – SLC01B1	\$1,405,163
Warfarin – CYP2C9/VKORC1	\$371,649

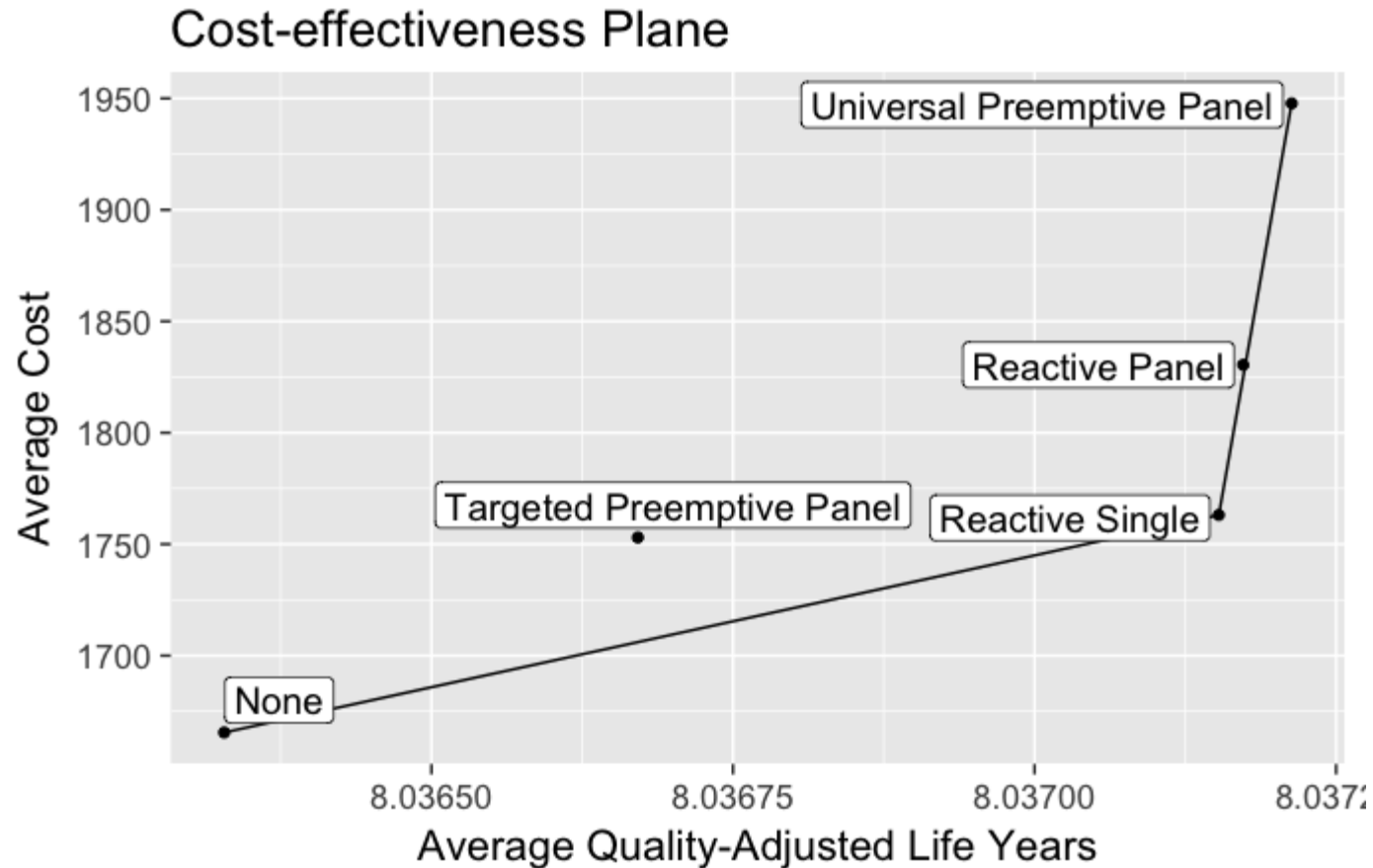
Comparing Four Genotyping Strategies

Three Drug Model

\$100 Single Drug Test
and \$250 Panel Test

STRATEGY	ICER to Base*
None	NA
Reactive Single	118,366
Reactive Panel	195,256
Targeted Preemptive Panel	255,173
Universal Preemptive Panel	318,972

Comparing Four Genotyping Strategies



IGNITE Antiplatelet CYP2C19 Simulation

Strategy	Average Cost	Genotyping Cost	Average Drug Cost	Avg. Event Cost
Clopidogrel Only	\$6,164	NA	\$786	\$5,378
CYP2C19 Guided - Prasugrel	\$6,137	\$100	\$1,232	\$4,804
CYP2C19 Guided - Ticagrelor	\$6,046	\$100	\$1,086	\$4,860

Sensitivity Analyses: Behavior

3 – Drug Model: Reactive Panel Strategy

Clinician Behavior	ICER Compared to No Genotyping
Reactive: Orders and uses 100%	\$195,256
Reactive: Orders 50% and Uses 100%	\$235,408
Universal Preemptive: Order 100% but use 25%	\$1,466, 076



RATIONAL INTEGRATION OF
GENOMIC HEALTHCARE TESTING

RIGHT is a research group based at Vanderbilt University Medical Center estimating the clinical benefits of multiplexed genetic testing across health systems.



FEATURES A

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed a lorem quis neque



FEATURES B

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed a lorem quis neque



FEATURES C

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Publically Hosted Simulation Tools

<https://rightsim.org/RIGHT/>

Clopidogrel Simulation

A discrete event simulation model for evaluation of clinical benefit and costs-effectiveness of utilizing pharmacogenomic testing in Simvastatin treatment

Run Save

Parameters

Simulation Population Costs

Sample Size

1000

Time Horizon (Year)

1 9 17 25 33 41 49 57 65 73 80

Genotyping Strategy (by default no testing)

CYP2C19 genotyping

Simulation Results

Event Counts

Show 25 entries

Search:

Event	None	Genotyping
N	1000	1000
Secular Death	127	127
Single Test	0	1000
DAPT Start	1000	1000
Drug Exposure	2000	2000
Clopidogrel	1000	779
Ticagrelor	0	221

The RIGHT Team



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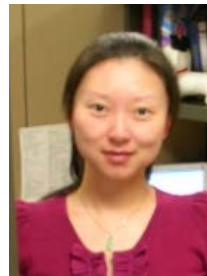
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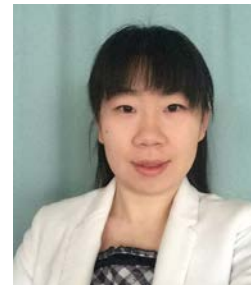
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RATIONAL INTEGRATION OF
GENOMIC HEALTHCARE TESTING