



The Value of Pharmacogenomic Panel Testing

National Academy of Sciences *Implementing and Evaluating Genomic Screening Programs in Health Care Systems: A Workshop*

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Objectives

- I. Describe our experience with PREDICT – a preemptive (i.e. screening) pharmacogenomic program.
- II. Determine the long term value of pharmacogenomic panel testing (RIGHT)

Multiplexed Panel Testing

- Economy of scale – incremental cost of ascertainment approaches 0

- Broadens the opportunities to perform testing

- Pre-emptive testing
- Reactive testing

- Behavior: No need for physicians to remember to order

- Behavior: Prescribing clinician may not want responsibility of additional data

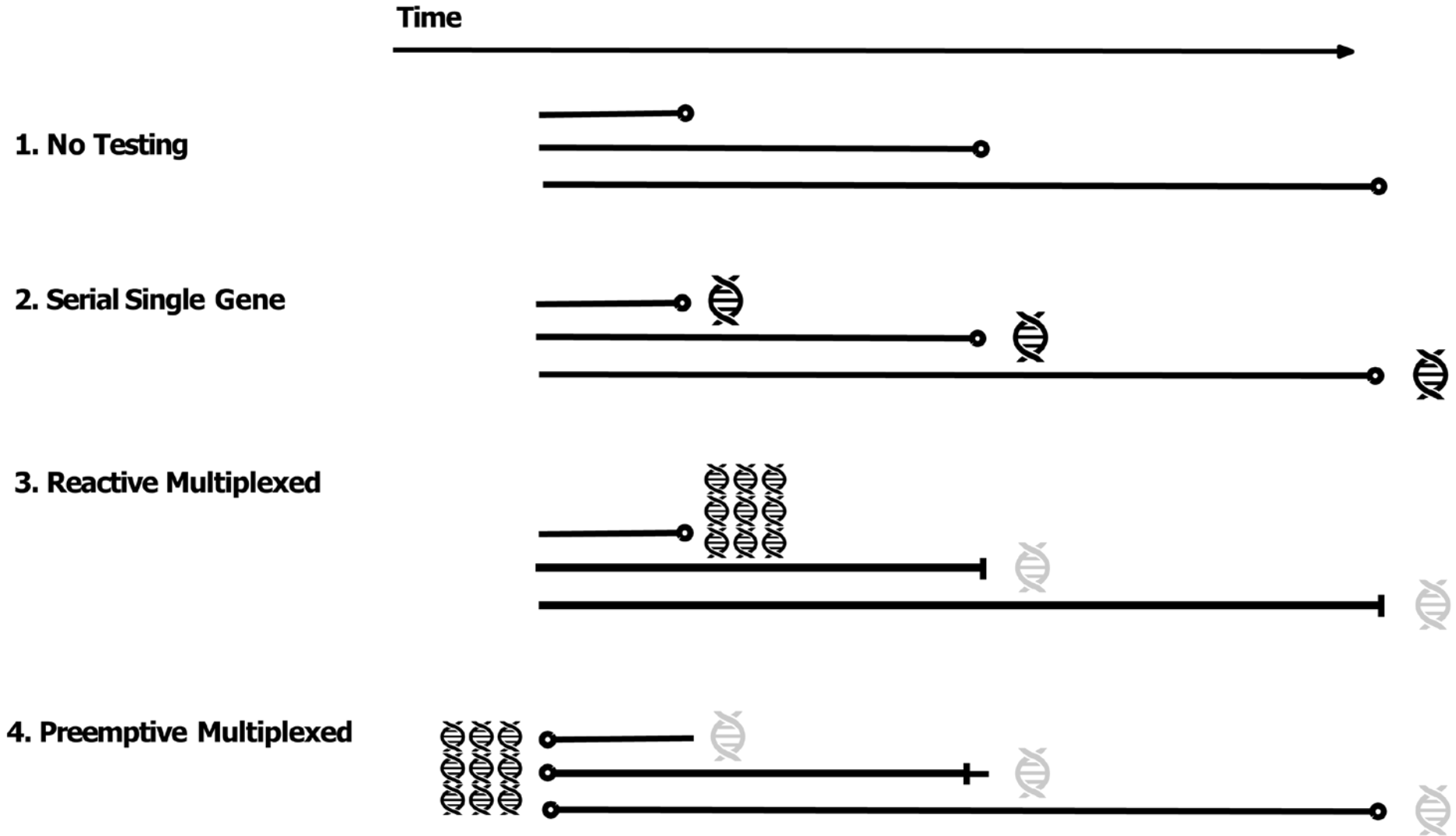
- Panel testing is more costly (assay + management)

- The information may never be used

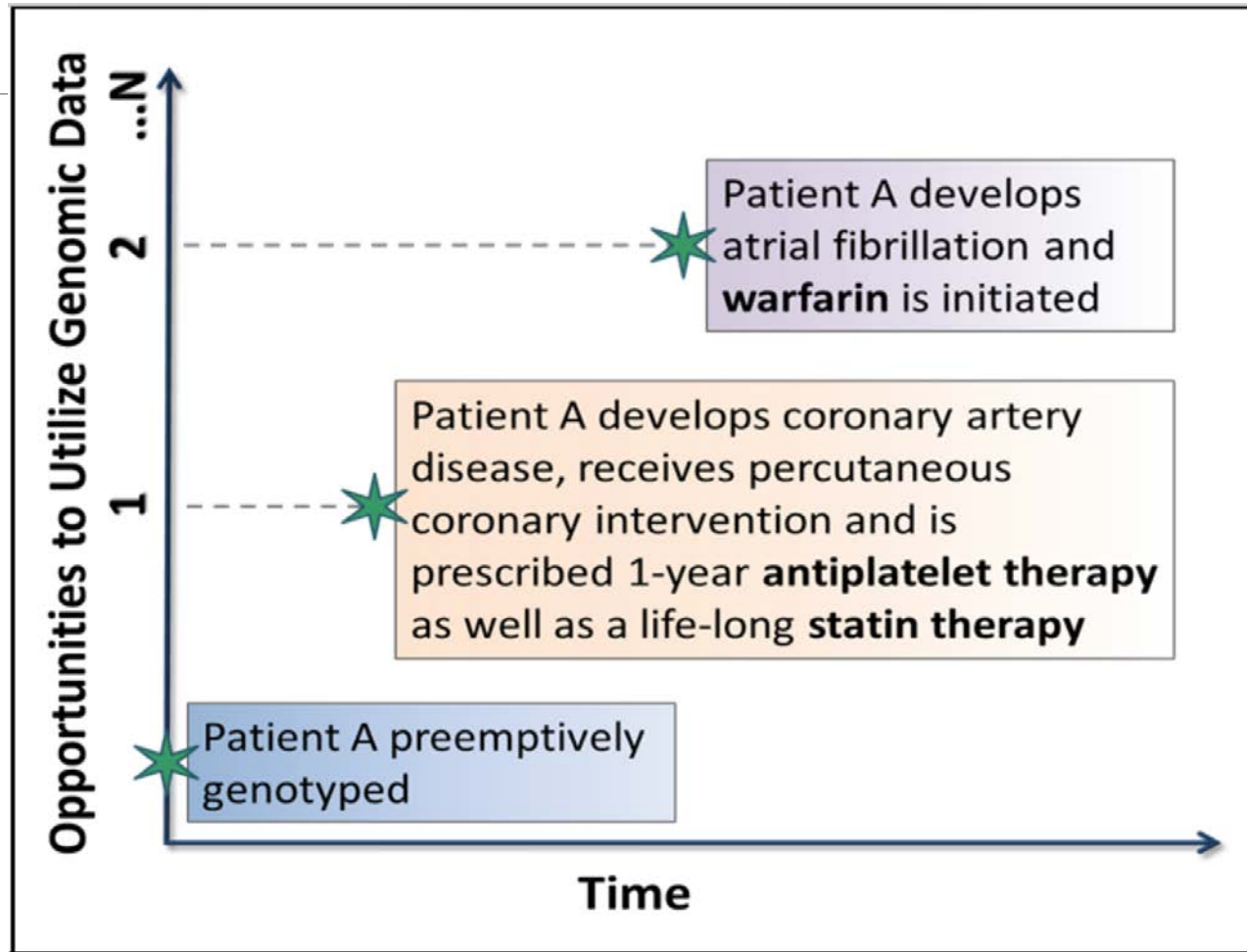
- Benefits are accrued in the future when testing methodologies will be improved

- Unintended or unwarranted costs related to cascade testing

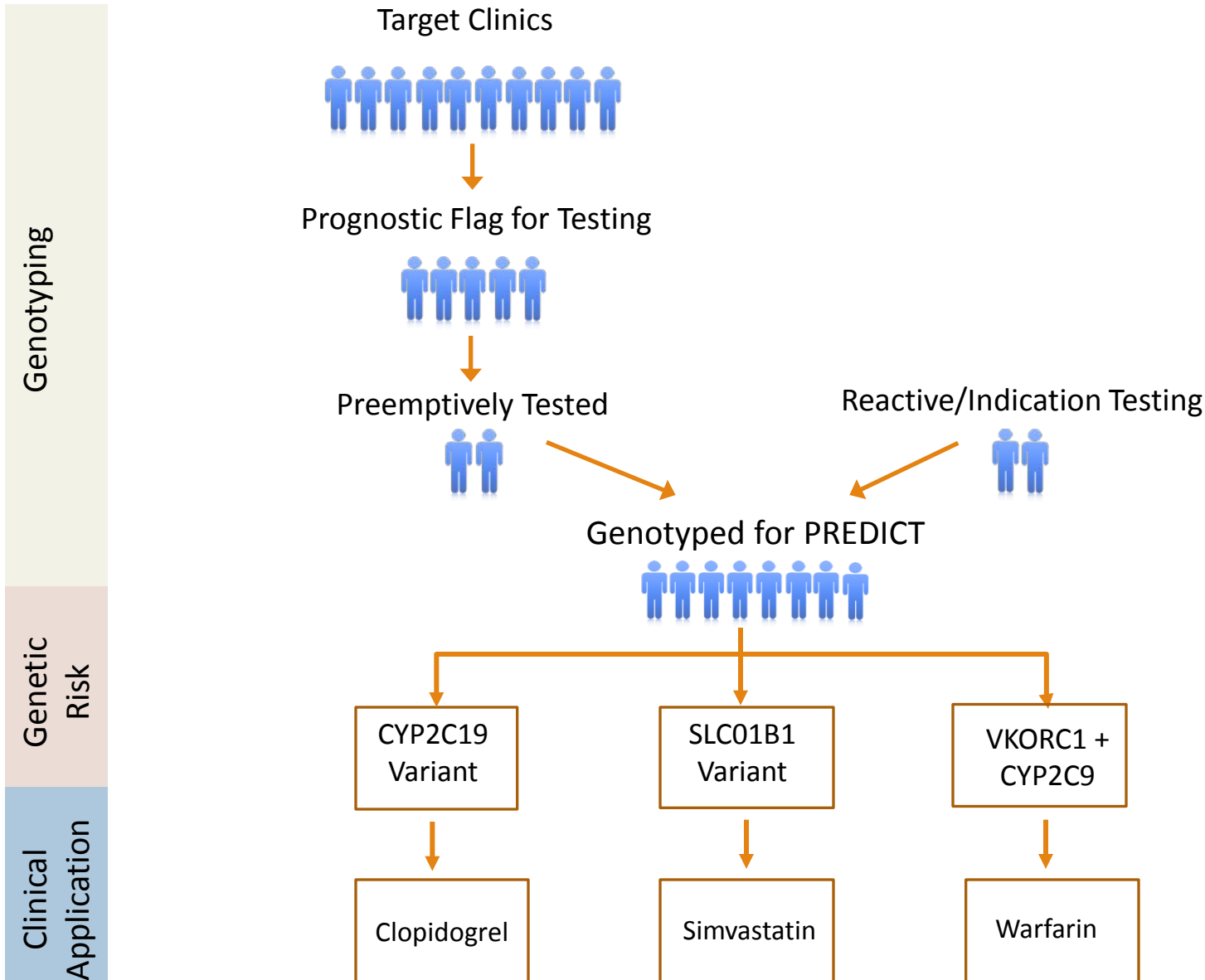
Testing Strategies: Screening vs Just - in- Time



Prototype Patient Scenario for PGx Screening



Pharmacogenomics: PREDICT Model



Has genetic risk
variant

Exposed to new or
recent prescription

Antiplatelet Advisor - Best Practice Alert

BestPractice Advisory - Interface, Predict Opb

⚠ Drug-Gene Interaction

Clopidogrel Intermediate Metabolizer Rules

Genetic testing has been performed and indicates this patient may be at risk for inadequate anti-platelet response to clopidogrel (Plavix) therapy

This patient has been tested for CYP2C19 variants, which has identified the presence of one copy of a risk allele which is associated with poor metabolism of clopidogrel. Intermediate metabolizers treated with clopidogrel at normal doses exhibit higher rates of stent thrombosis/other cardiovascular events.

Treatment modification is recommended if not otherwise contraindicated:

- Prescribe ticagrelor (BRILANTA) 90 mg twice daily

Ticagrelor should **not** be given to patients that have a history of severe hepatic impairment or intracranial bleed

[Evidence Link](#)

The Vanderbilt P&T Committee has approved this recommendation based on the detailed review of the literature and consensus guidelines.

Remove the following orders? _____

Remove

Keep

🏠 clopidogrel (PLAVIX) 75 mg tablet

Take 1 tablet (75 mg total) by mouth daily. Normal, Disp-30 tablet, R-11

Apply the following? _____

Order

Do Not Order

🏠 prasugrel (EFFIENT) tablet 10 mg

Order

Do Not Order

🏠 ticagrelor (BRILINTA) tablet 90 mg

✓ **Accept**

Dismiss

Patient Notification of Drug Sensitivities

VANDERBILT UNIVERSITY MEDICAL CENTER ▾

Pay HOLIDAY VOID#ZTESTSYC's Bill

Hi, HOLIDAY VOID#ZTESTSYC ▾



MY HEALTH HOME

HELP

GUIDE

For Patients
and Visitors



Appointments



Messages



My Record



My Forms



Health Management



My Accounts

Go to:

Genes that Affect My Medicines ▾

Personalized Medicine

Each person responds differently to medicines. Your genes play a role in how you respond to medicines. Based on your history, your provider has ordered a test to learn more about which drugs are right for you. Having this information can help predict and prevent bad drug side effects.

Medication

**Does your genetic test result affect
your response to medicines?**

Clopidogrel/Plavix®

Yes

Simvastatin/Zocor®

Yes

Tacrolimus®

Yes

Thiopurine Therapy®

Yes

Warfarin/Coumadin®

Yes

The Clopidogrel Test

Show less >

Clopidogrel (sounds like "kloh-PID-oh-grel") is a blood thinner used to prevent clots that can cause a heart attack or stroke. Your genes can affect how well the drug works. This genetic test identifies how well you may respond to clopidogrel.

Your Risk

Show less >

Sometimes clopidogrel does not prevent harmful strokes or clots as well as it should because of your genes. Your provider, often with the results of a lab test, can determine if clopidogrel is the right medicine for you.

The results of your test show that you have two versions of the gene that may put you at increased risk for this negative outcome.

More About Clopidogrel

Show more >

More About Your Risk

Show more >

Pertinent Lessons

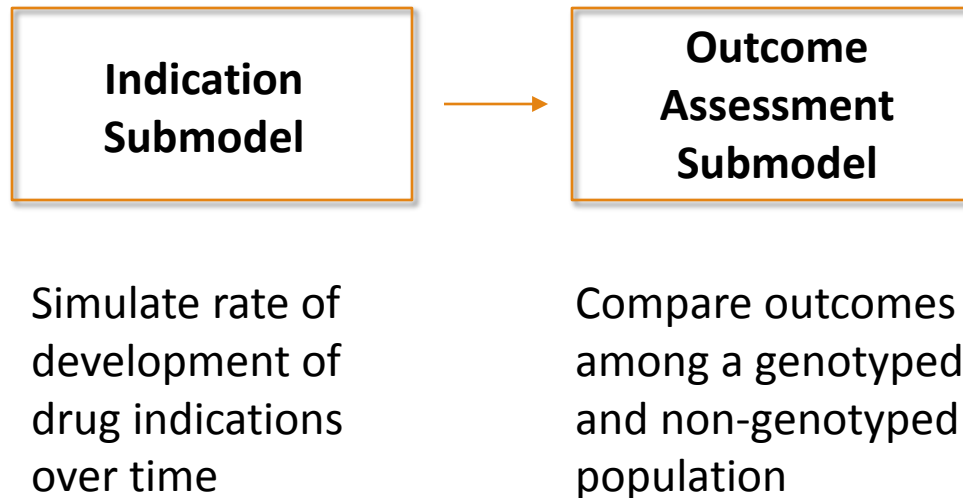
1. Cost is a concern: cost of the test, expectation of reimbursement, out of pocket costs
2. Strength of evidence and guidelines matter
3. Clinical behavior is diverse as pharmacogenomic screening data is not deterministic

Peterson, GIM 2016

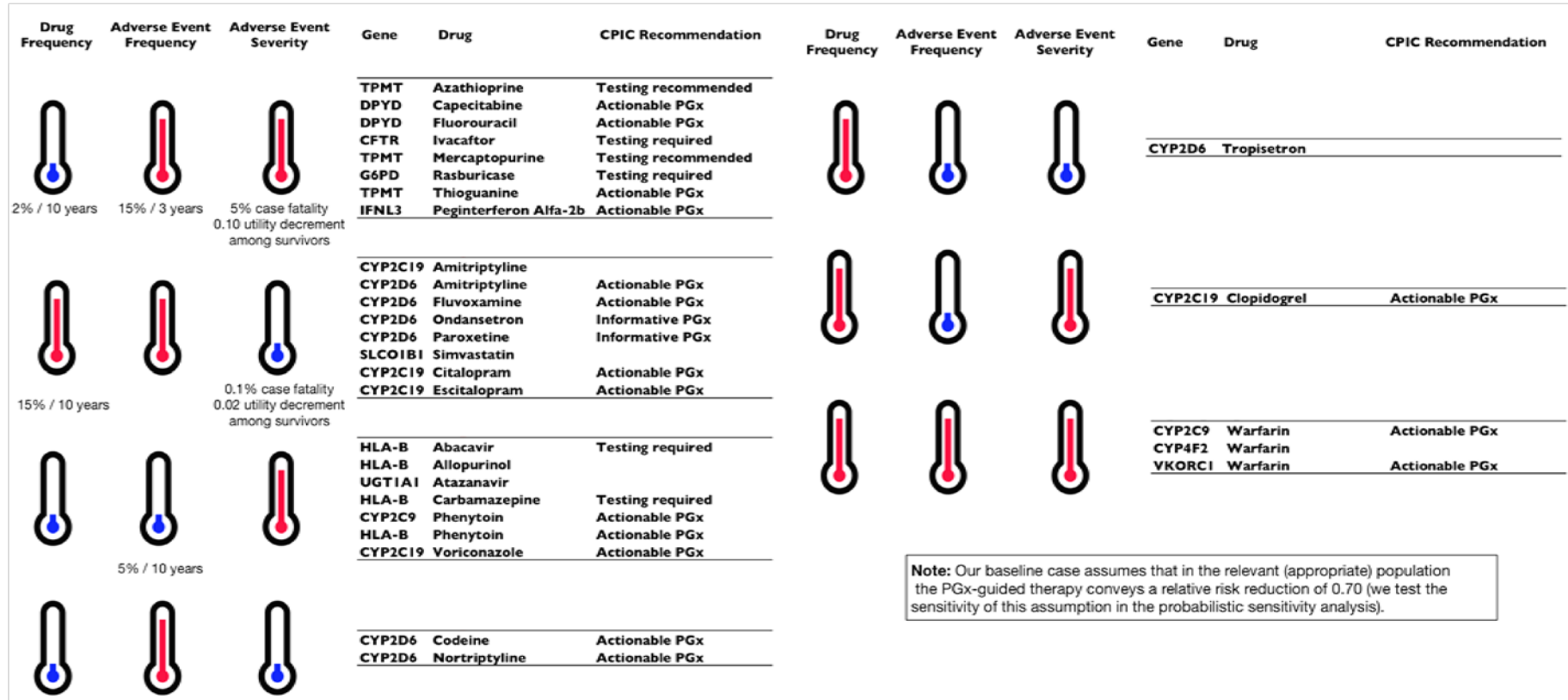
Peterson, CPT 2016

Unertl, Personalized Medicine 2016

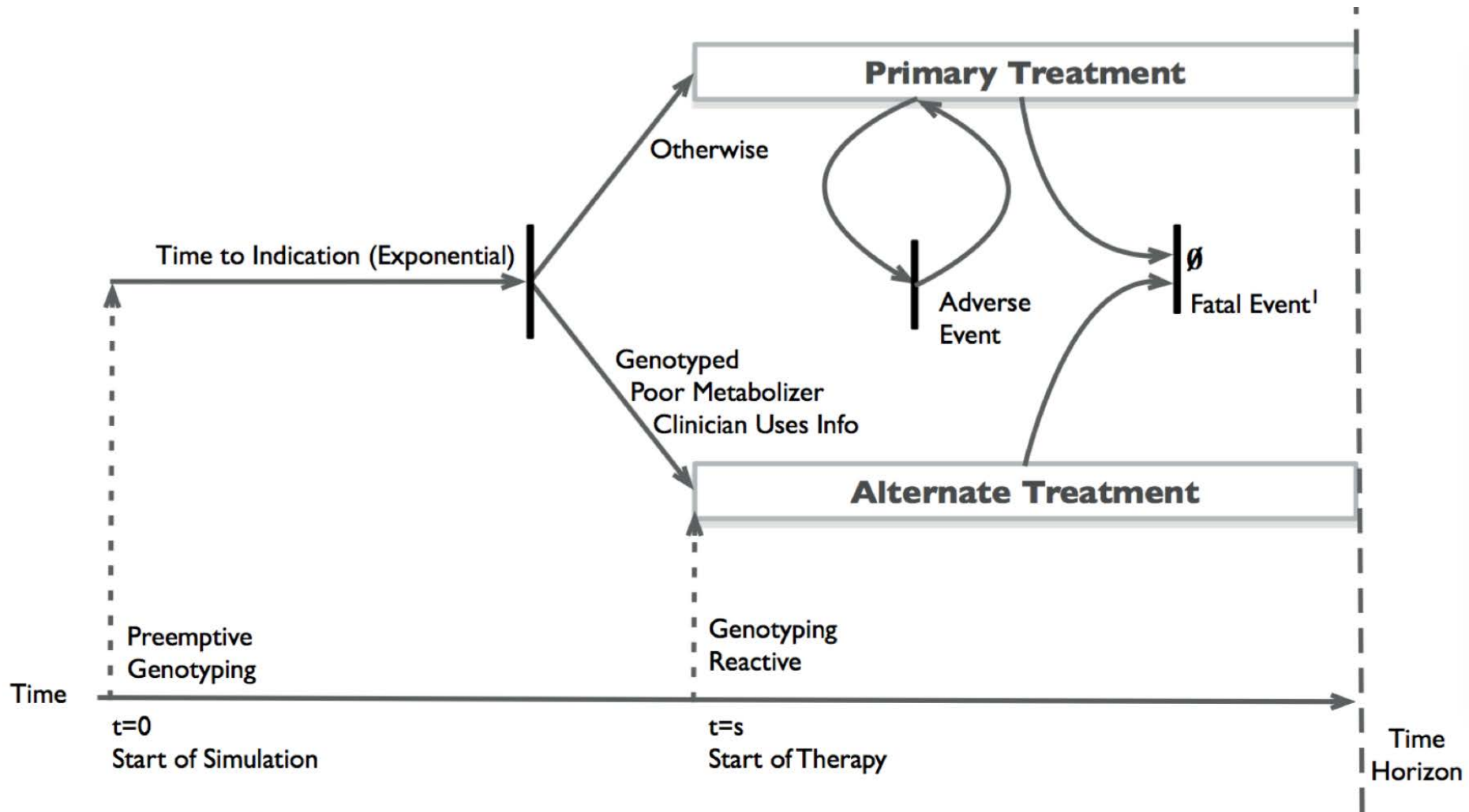
Determining Value of PGx Testing: Discrete Event Simulation (DES)



Challenge: There are 46 CPIC level-A recommendations. To fully model cost-effectiveness, must have a model for each.

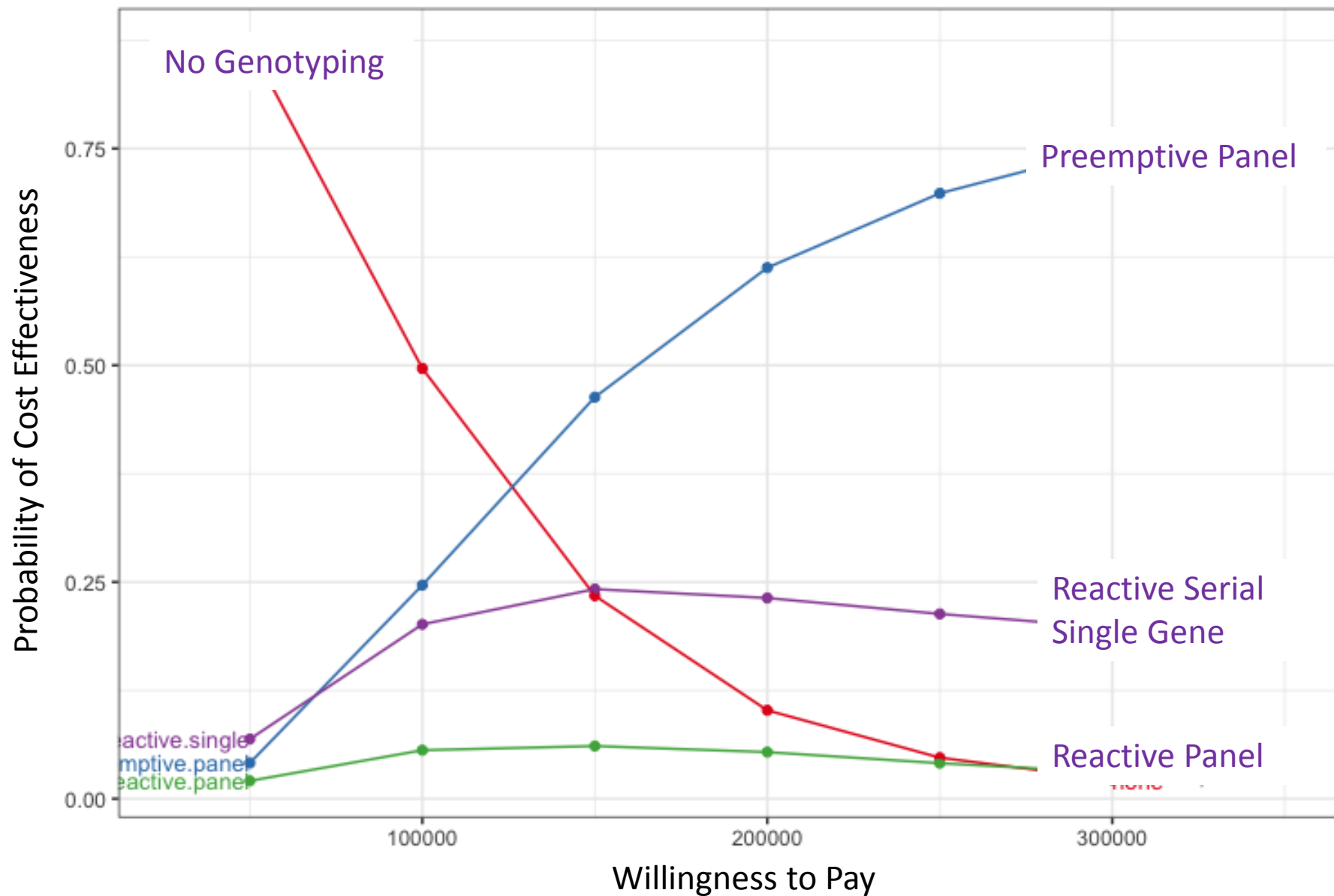


Methods: Simple Genotyped Tailored Therapy Model

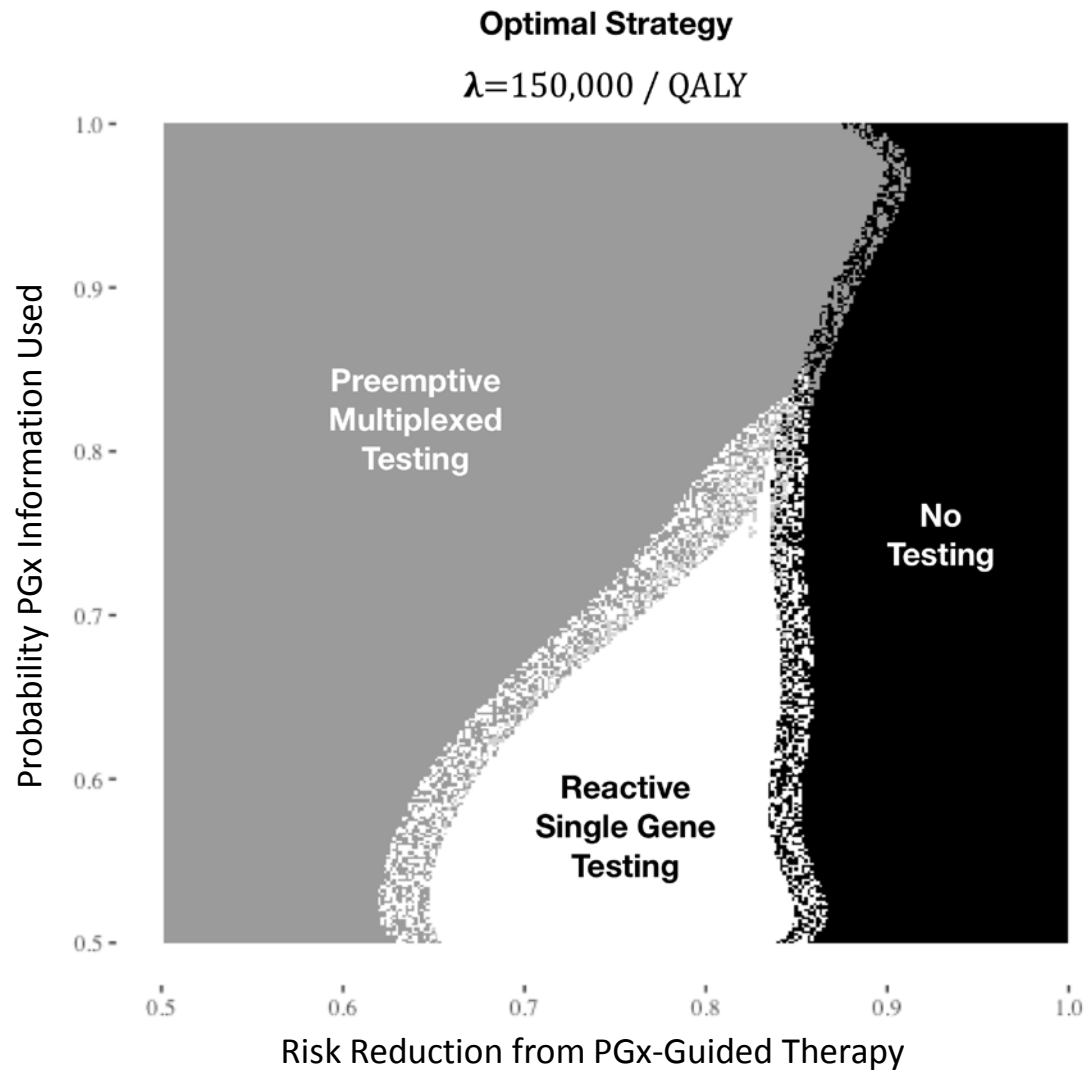


Key Parameters and Assumptions

- PGx-guided therapy costs 3-fold more
- PGx guidance conveys **0.70 relative risk** of adverse events.
- If not preemptively screened, a genetic test is ordered 50% of the time.
- Any genetic information obtained upstream is utilized 75% of the time.
- **These are optimistic assumptions;** we test the sensitivity of the findings to nearly all assumptions in Aim 3.



Sensitivity Analysis: Cost-Effectiveness of Multiplexed Testing Strategies



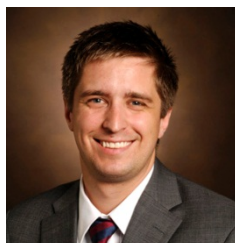
Summary

- Methodologies to assess value of panel testing are now available
- Screening multiplexed pharmacogenomic testing is cost-effective under a moderately wide range of assumptions
- However, the time frame for accrual of those benefits to achieve typical CE is long
- Limited by traditional CE measures; missing the value of knowing and confidence in safety and efficacy of prescription

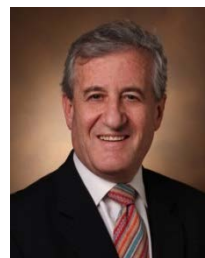
The RIGHT Team



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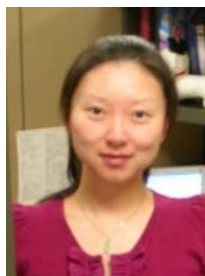
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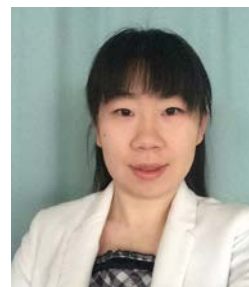
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NIH Common Fund U01HL122904



RATIONAL INTEGRATION OF
GENOMIC HEALTHCARE TESTING