ECONOMICS AND (MATURING) GENOMIC MEDICINE

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Ay, Captain! Funding Cuts Port Side!
Ahoy! Big Deal Ahead

Goals: Answer Three Questions

- Why do we care?
- What do we know?
- What are the barriers?

+ Make a couple of points about cost-effectiveness analysis along the way

+ Provide a little levity

Why Do We Care?

- Large potential expenditures
  - Costly tests
  - Costly illnesses
  - Adverse side effects
- Affect healthcare in multiple ways
- Affect the costs of healthcare research (e.g., size of trials)

What Do We Know?

- Not so much

Great uncertainty about the effect on either health care costs and actual well-being (both the intended therapeutic benefits as well as adverse side effects)

- Not as much as we might know because of methods quality

- More than we did 10 years ago

- Could grow rapidly
  - Standard question
  - Avoids trickier elements

Trickier Elements Lacking

EX: Screening young children for bad behavior

- No issue of sensitivity and specificity
- No issue of developmental changes in measurement
- No issue of change over time
- No issue of long-term projections of costs

Don’t Worry—It’s still hard enough!

What Are the Barriers?

- Short-term problems that will resolve as evidence accumulates (variability in estimated costs of tests)
- Sub-standard methodology
  - Problems (time horizon)
  - Improving
  - Guidelines available
- Problems Common to All CEA

Problems Common to All CEA

- Require extensive information

  Barriers to getting the information (such as side effects)
- Goofball QALY
- Costing
- Efficacy v. effectiveness
- Ignore relevant questions
  - Startup, capacity costs

  Fixed (?) costs
  - Aggregate costs

Table II. Questions to consider in assessing the cost effectiveness of a pharmacogenomic treatment strategy

What is the frequency of the genetic polymorphism?
How closely is the polymorphism linked to a consistent phenotypic drug response?
Are there metabolic, environmental or other significant influences on drug response?
What are the sensitivity and specificity of the genomic test?
What alternative tests are available to predict drug response?
How prevalent is the disease of interest?
What are the characteristic outcomes associated with the disease with and without treatment?
How does the pharmacogenomic strategy alter these outcomes?
What is the therapeutic range of the drug involved?
What alternative treatment options are available?
How effective are current monitoring strategies for preventing severe ADRs and predicting drug response?

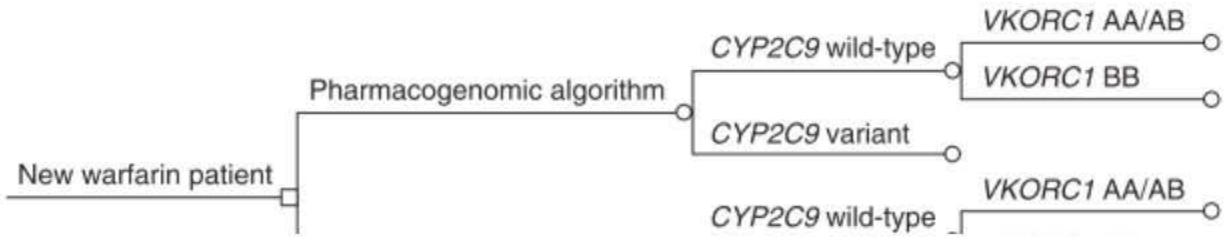
ADRs = adverse drug reactions.

Problems Common to All CEA

- Require extensive information

  Barriers to getting the information (such as side effects)
- Goofball QALY
- Costing (v. charges v. payments)
- Efficacy v. effectiveness
- Ignore relevant questions
  - Startup, capacity costs

  Fixed (?) costs
  - Aggregate costs



A Policy Model to Evaluate the Benefits, Risks and Costs of Warfarin Pharmacogenomic Testing

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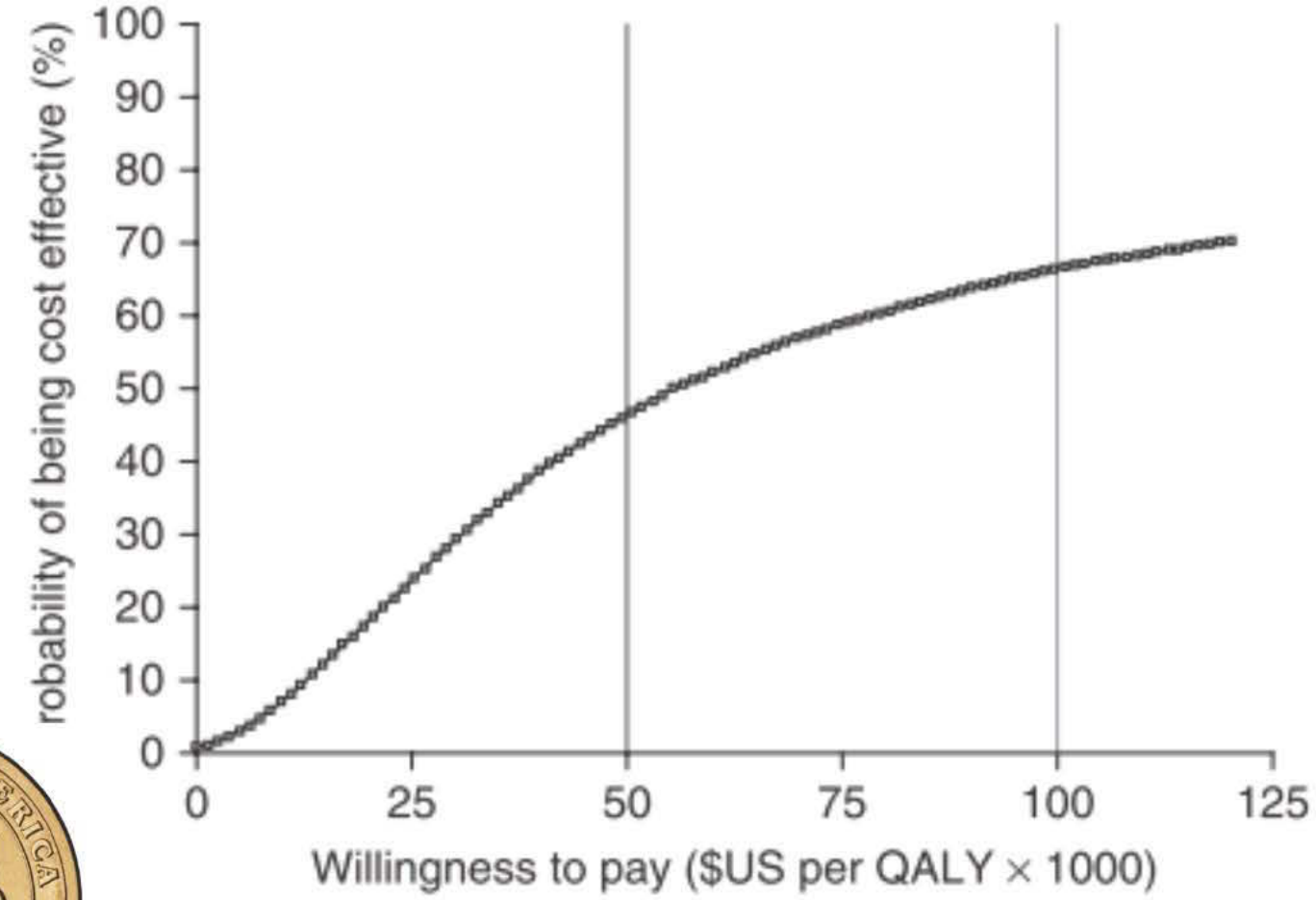
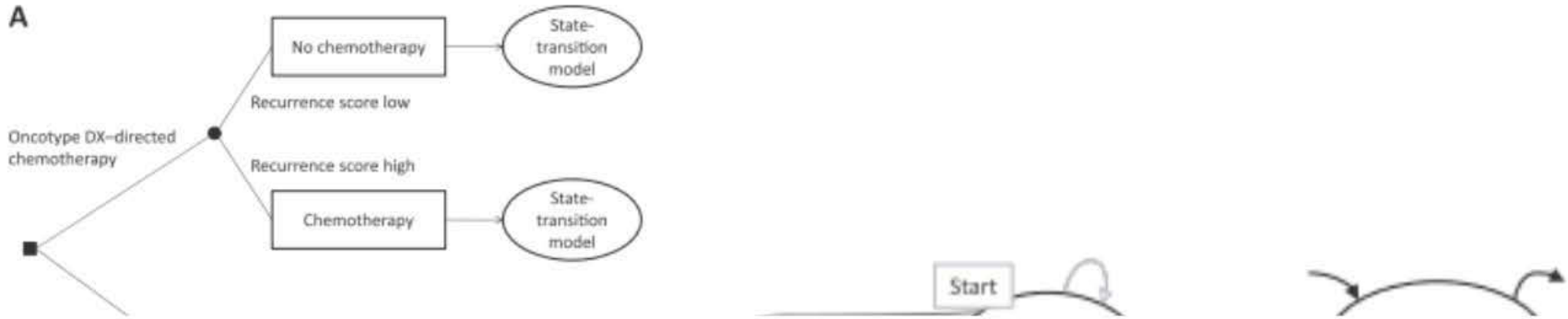
Fig. 1. Simplified schematic of the decision model. Patients who need warfarin are classified according to whether initiation was pharmacogenomics based and genotype. Patients entered the Markov model in the 'well' state, transitioning to health states in monthly cycles. Transition probabilities were based on the percentage of time spent in, above and below therapeutic range, which were in turn based on genotype and intervention. ***CYP***=cytochrome P450.



5. Cost-effectiveness acceptability curve. The curve represents probability that the pharmacogenomic-based warfarin initiation is cost effective at various willingness-to-pay thresholds (year 2007 values). The curve was generated from the Monte Carlo simulations.



Economic Evaluation of Genomic Test–Directed Chemotherapy for Early-Stage Lymph Node–Positive Breast Cancer

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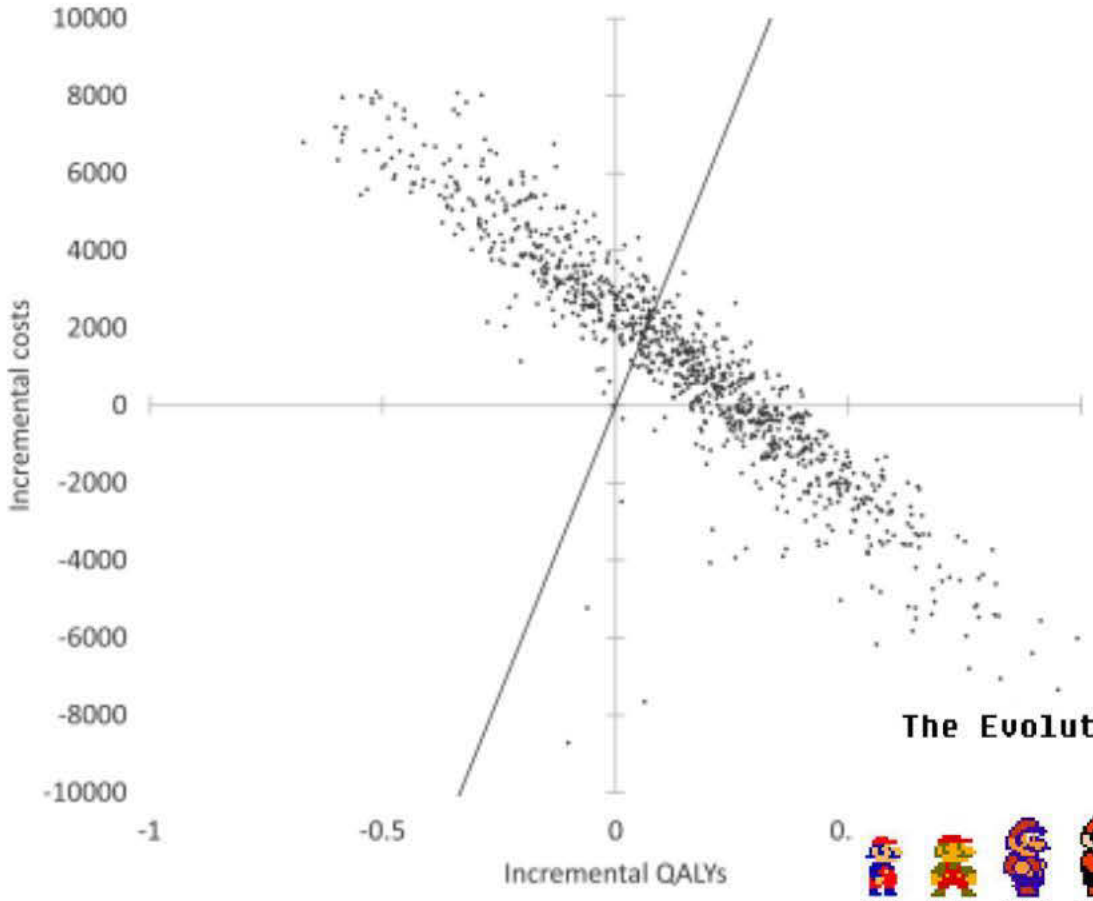
and cost savings produced. This economic evaluation compared genomic test–directed chemotherapy using the Oncotype DX 21-gene assay with chemotherapy for all eligible patients with lymph node–positive, estrogen receptor–positive early-stage breast cancer.

Figure 1. Model structure. **A**) Decision tree. The model is evaluated for a control scenario, where all patients receive chemotherapy, or a test-directed scenario, where patients are allocated to chemotherapy or



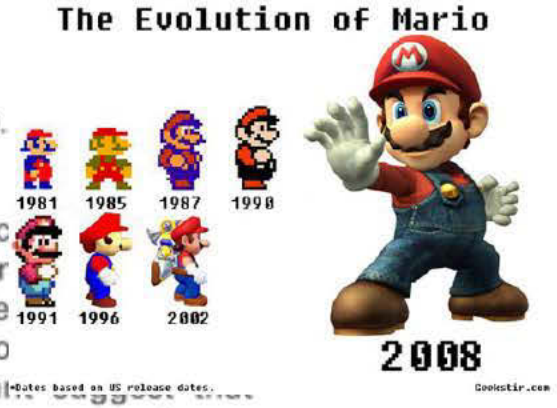


Figure 3. Incremental cost-effectiveness plane. Unc
cost-effectiveness estimate is represented here by plottir
in costs (incremental costs) against the difference in effe
quality-adjusted life-years [QALYs]) for 1000 simulatio
the model. **Points plotted in the upper left** quadra

term anthracycline-related cardiac toxicity, quality of life, test cost, and the time horizon. The highest priority for further research identified by value of information analysis is the recurrence rate in test-selected subgroups.

costly (therefore cost-effective). **Points in the upper right** quadrant are cost-effective if they lie above the **diagonal line**, which represents a

What Uses are Likely to Be Cost-Effective?

(i) the polymorphism under consideration is prevalent in the population and has a high degree of penetrance;

(ii) genetic testing is highly sensitive and specific, and less costly alternative tests that could be used to individualize therapy are not readily available

(iii) the disease state involves outcomes with significant morbidity or mortality if left untreated; and

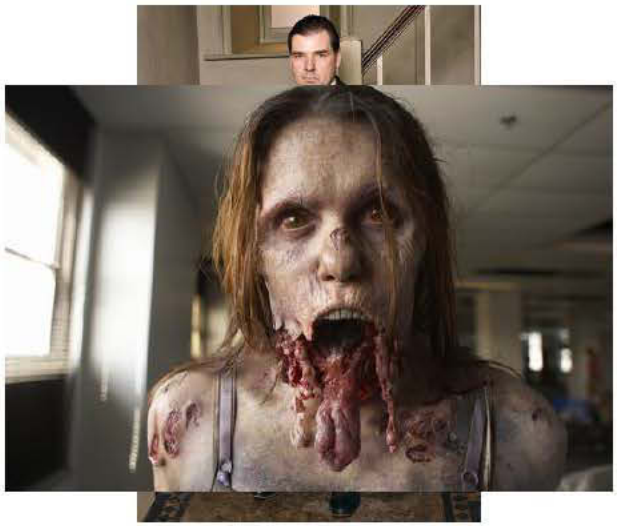
(iv) the treatment involves significant outcomes and/or costs that can be impacted by genotype-individualised therapy

Flowers, C. R., & Veenstra, D. (2004). The role of cost-effectiveness analysis in the era of pharmacogenomics. Pharmacoeconomics, 22(8), 481-493.

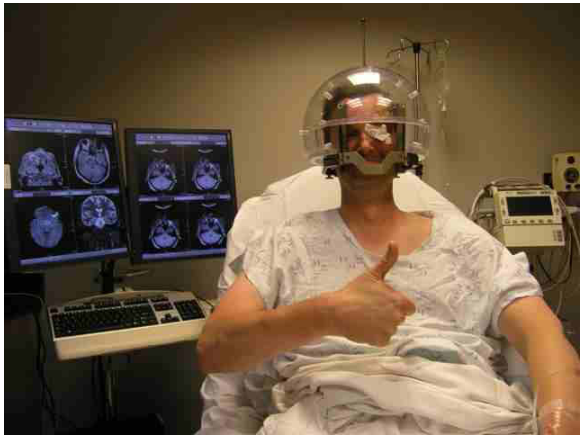
So, Let's Get Started!

- Basic information would be very useful (e.g., costs alone)
- Refinement over time—where to focus?
- Further wrinkles await

(e.g., Other potential costs involving relatives of the patient and loss of insurability)

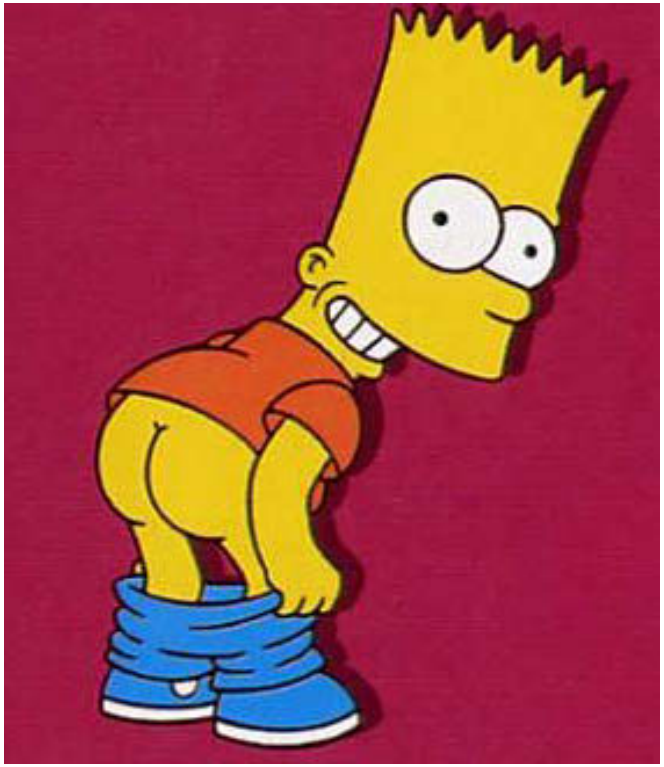


Don’t Forget!



- A good cost-effectiveness study provides probabilistic answer
- The cost-effectiveness analysis should evolve with your field

For Discussion: Is the Field Mature Enough?



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