Personalized Healthcare in a Learning Healthcare System

Eleventh Population Health and Care Coordination Colloquium
Philadelphia, PA
March 15, 2011
The Underlying Cause of Change

- Healthcare expense growth is now pervasive
  - Affecting all stakeholders; patients, employers, private payers, states, and the federal government.
- The quality of care being delivered today is increasingly recognized as suboptimal
  - Recommended care not implemented effectively and misaligned incentives not serving the patient.

The current situation is not sustainable, and no single part of healthcare, any single industry, any one company or agency can do it alone.
“Starkly put, for every dollar Congress allocates to develop breakthrough treatments, it allocates one penny to ensure that Americans actually receive them.”

Dr. Steven Woolf, The Washington Post

January 8, 2006
...and a New Kid on the Block

FY 2010 Budgets (in millions)

$30,800
$3,200
$372
$1600

NIH  FDA  AHRQ  PCORI

“Starkly put, for every dollar Congress allocates to develop breakthrough treatments, it allocates one penny to ensure that Americans actually receive them.”

Dr. Steven Woolf, The Washington Post
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Patient-centric Outcomes Research Institute
Elicits a re-evaluation of the basic value proposition...

Value in health care is often expressed as the increment in clinical benefit achieved (health and/or quality of life improvement), for those receiving a particular service or set of services, in conjunction with the investment required.
… and generates a new refrain in healthcare

Pay for What Works
Eliciting a new series of questions

What works?

...What works best?

...for whom?

...under what circumstances?

...in a cost effective way?
That can be interpreted as

- What works – efficacy and safety
- …What works best – comparative clinical effectiveness
- …for whom – personalized healthcare
- …under what circumstances – real world effectiveness
- …in a cost effective way – coverage and reimbursement
For Healthcare Sectors

e.g. Product Developers

- New thinking is required
  - The old hurdles...
    - Efficacy
    - Safety
    - Production assurance
  .. are no longer sufficient
For Healthcare Sectors

e.g. Product Developers

- New thinking is required
  - Three new hurdles must be cleared as well...
    - Effectiveness
    - Coverage
    - Reimbursement

  ...looking beyond market approval toward greater embedment in clinical practice.
For Healthcare Sectors
e.g. Product Developers

- New thinking is required
  - Innovation itself is no longer sufficient, the value of innovation must be proven
    - In the clinic
    - With real patients
    - And real providers
    - In a cost effective way
The Problem
Unsustainable Cost of Innovation

Average R&D costs per NCE drug launched

- Extensive Comparative Effectiveness: $2,300
- Limited Comparative Effectiveness: $2,000
- Post-launch costs: $802

Year:
- 2000: $95
- 2003: $1,400
- 2010: $2,300

Source: Historical data from DiMasi, Tufts Center for Drug Development
Everybody responds to therapy differently

Who suffers when therapies don’t work?

- Patients
- Physicians
- Payers

Percentage Non-responders

- Hypertension Drugs 10-30%
- Heart Failure Drugs 15-25%
- Anti Depressants 20-50%
- Cholesterol Drugs 30-70%
- Asthma Drugs 40-70%
The Solution
New development paradigms

Therapy defined, rolling NDA, disease biomarker devel.

New development paradigms

Trials designed with payers & regulators

Simulation - based trial design

Adaptive pivotal studies

Surrogate endpoints delineate benefit/risk

PA – Progressive Authorization
Before duration based on 2001-2003 Industry Median (CMR)

Outcomes confirm surrogate hypothesis; reimbursement confirmed; safety profile acceptable; alternative evidence generation, continuous learning

Earlier revenue with more gradual increase in patient exposure

Future Development

PA

Continuous Data Acquisition

Outcomes

Diagnosis Codvelopment

1                 2                 3                 4                 5                 6                 7                 8                 9                 10                11                12

FIM - POP
POP –> Release
(30 mo)
(5y2m)
(42 mo)
(3 mo)
The Solution:
Access to the right therapy

Patient Population

Severe Symptoms

Moderate Symptoms

Mild Symptoms

= Predicted Responders

= Predicted Low Efficacy or Side Effects
The Solution:
Quicker uptake of therapeutic value

Breast Cancer Therapies: Global Sales from Launch

- Traditional
- PHC

Adjuvant approval:
- EMEA May 06, US FDA Nov 06

ASCO presentation of adjuvant data (May 05)

5 year analysis of ATAC data

Initial adjuvant indication in US

Year 1, Year 2, Year 3, Year 4, Year 5, Year 6, Year 7, Year 8, Year 9, Year 10, Year 11, Year 12

$\text{m}$
The Solution:
Towards Preventive Medicine

- Avoiding futile medicine
- Predictable therapeutic response
- Earlier intervention
- Delay onset and minimize severity
Two needs for evidence...

- Confirming real-world **comparative clinical effectiveness** must constitute a core element of clinical development plans,
  - developed not only in consultation with the FDA,
  - but with other entities, i.e.,
    - Center for Medicare Services (CMS),
    - Agency for Healthcare Research in Quality (AHRQ),
    - Health Technology Assessment (HTA) at private payers,
  ...and...
    - NICE comes to America (PCORI)
...and...

- Generating meaningful segmentation of patient populations, by whatever technology is appropriate (genomic, imaging, informatic), in order to increase the benefit of therapy

...Personalized Healthcare
...evolving the “P” for the future

P...ersonalized Healthcare

P...rescriptive

P...recision

P...reventive

P...articipatory

P...erformance??
Is PHC only about genomics?

Case Study – Informatic PHC

Can a large and fully integrated Electronic Health Record System (EHR) be used to demonstrate the value of antidiabetic therapy, in terms of comparative benefit and risk, in an environment reflecting actual clinical use of the therapy?
<table>
<thead>
<tr>
<th>Enter your information below, then click &quot;Submit&quot; for results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong> 40</td>
</tr>
<tr>
<td><strong>Gender / Race</strong> Female</td>
</tr>
<tr>
<td><strong>Serum Creatinine</strong> 1</td>
</tr>
<tr>
<td><strong>Urine Albumin / Serum Creatinine Ratio</strong> 0-29.9</td>
</tr>
<tr>
<td><strong>History of Heart Disease</strong> Yes</td>
</tr>
<tr>
<td><strong>Height (inches)</strong> 70</td>
</tr>
<tr>
<td><strong>Weight (pounds)</strong> 150</td>
</tr>
<tr>
<td><strong>History of Stroke or TIA</strong> Yes</td>
</tr>
<tr>
<td><strong>Atrial Fibrillation</strong> Yes</td>
</tr>
<tr>
<td><strong>History of Heart Failure</strong> Yes</td>
</tr>
<tr>
<td><strong>Blood Pressure</strong></td>
</tr>
<tr>
<td>Systolic</td>
</tr>
<tr>
<td>Diastolic</td>
</tr>
<tr>
<td><strong>Lipid Levels</strong></td>
</tr>
<tr>
<td>HDL</td>
</tr>
<tr>
<td>LDL</td>
</tr>
<tr>
<td><strong>Triglyceride</strong></td>
</tr>
<tr>
<td><strong>Smoking Status</strong> Never/Past</td>
</tr>
<tr>
<td><strong>Is the patient currently on Insulin or will you prescribe it today?</strong> Yes</td>
</tr>
<tr>
<td><strong>On ACE Inhibitors or ARB</strong> ACE or ARB</td>
</tr>
<tr>
<td><strong>Elevated Liver Enzymes</strong> (ALT 3 x normal or T Bilir. 2 x normal) Yes</td>
</tr>
<tr>
<td><strong>History of Liver Disease?</strong> Yes</td>
</tr>
<tr>
<td><strong>History of Hepatitis B or C?</strong> Yes</td>
</tr>
<tr>
<td><strong>History of Renal Disease?</strong> Yes</td>
</tr>
<tr>
<td><strong>Left Ventricular Ejection Fraction</strong> 50</td>
</tr>
<tr>
<td><strong>Hemoglobin A1c</strong> 8</td>
</tr>
<tr>
<td><strong>When was diabetes diagnosed?</strong> Diagnosed prior to Today</td>
</tr>
<tr>
<td><strong>Is the patient currently on Plavix® or will you prescribe it today?</strong> Yes</td>
</tr>
<tr>
<td><strong>Is the patient currently on Aspirin or will you prescribe it today?</strong> Yes</td>
</tr>
<tr>
<td><strong>Is the patient on a cholesterol med or will you prescribe one today?</strong> Yes</td>
</tr>
<tr>
<td><strong>If yes to the above question, was patient on a cholesterol med at the time of the lipid panel that was entered?</strong> Yes</td>
</tr>
<tr>
<td><strong>Is the patient on Statins?</strong> Statin + fibrin acid or niacin</td>
</tr>
</tbody>
</table>

**Submit**
<table>
<thead>
<tr>
<th>OUTCOMES (6 year probabilities)</th>
<th>Big</th>
<th>Meg</th>
<th>SFU</th>
<th>TZD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>0.018</td>
<td>0.033</td>
<td>0.058</td>
<td>0.042</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.042</td>
<td>0.055</td>
<td>0.048</td>
<td>0.043</td>
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<tr>
<td>Coronary Artery Disease</td>
<td>0.039</td>
<td>0.035</td>
<td>0.069</td>
<td>0.022</td>
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<tr>
<td>Liver Injury</td>
<td>0.026</td>
<td>0.135</td>
<td>0.110</td>
<td>0.106</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.023</td>
<td>0.034</td>
<td>0.033</td>
<td>0.027</td>
</tr>
<tr>
<td>Renal Insufficiency</td>
<td>0.054</td>
<td>0.130</td>
<td>0.097</td>
<td>0.062</td>
</tr>
<tr>
<td>Diabetic Nephropathy</td>
<td>0.023</td>
<td>0.030</td>
<td>0.065</td>
<td>0.721</td>
</tr>
<tr>
<td>EMLI</td>
<td>25.6</td>
<td>26.8</td>
<td>25.4</td>
<td>27.6</td>
</tr>
<tr>
<td>Hemoglobin A1c(%)</td>
<td>8.0</td>
<td>8.1</td>
<td>7.9</td>
<td>7.6</td>
</tr>
<tr>
<td>HDL(mg/dl)</td>
<td>43.3</td>
<td>41.8</td>
<td>42.3</td>
<td>42.3</td>
</tr>
<tr>
<td>LDL(mg/dl)</td>
<td>106.3</td>
<td>104.6</td>
<td>106.0</td>
<td>95.3</td>
</tr>
<tr>
<td>Triglyceride(mg/dl)</td>
<td>115.8</td>
<td>113.2</td>
<td>117.7</td>
<td>105.5</td>
</tr>
</tbody>
</table>

This is a prototype that has not been fully tested.
Do not distribute.
Not for clinical use.
Predictions do not necessarily assume that patients will remain on this drug class for 6-years.
The new refrain in healthcare

- Comparative Effectiveness
- Personalized Healthcare
- Real World Effectiveness

HIT
Creating a Learning Healthcare System

- Model Updating
- Outcome Data Capture into EHR
- Therapeutic Decision
- Evidence-based Decision Support
- Patient Care Episode
...and a Learning Development System
Requires a Brave New World of Future Partners
Thank-you

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