Predictive Modeling and Disease Management Applications

Presented by: Steven Flores

Prepared for: The Predictive Modeling Summit

November 13, 2014
Disease Management – Introduction

A multidisciplinary, systematic approach to health care delivery that:

- Includes all members of a chronic disease population
- Supports the physician-patient relationship and plan of care
- Optimizes patient care through prevention, proactive, protocols/interventions based on professional consensus, demonstrated clinical best practices, or evidence-based interventions; and patient self-management
- Continuously evaluates health status and measures outcomes with the goal of improving overall health, thereby enhancing quality of life and lowering the cost of care
## Disease Management – The Transition

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Progressive</th>
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</thead>
<tbody>
<tr>
<td>Benefit-Centered</td>
<td>Member-Centered</td>
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<tr>
<td>Reactive</td>
<td>Proactive/Anticipatory</td>
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<tr>
<td>Cost-Containment</td>
<td>Quality/Outcomes</td>
</tr>
<tr>
<td>Acute episodes of care</td>
<td>Long-term Management</td>
</tr>
<tr>
<td>“Diagnosis” Driven</td>
<td>Interplay of Illness and Environment</td>
</tr>
<tr>
<td>Minimal Member/Physician Contact</td>
<td>Direct Member Contact   with Physician Collaboration</td>
</tr>
<tr>
<td>Arranging, Authorizing, Approving</td>
<td>Assessing, Planning, Coordinating, Monitoring, Evaluating</td>
</tr>
</tbody>
</table>
Predictive Modeling – Functional Definitions

Use of analytical and statistical techniques applied to specific clinical indicators (such as medical and pharmacy claims data, laboratory values, and other clinical information) to identify members who are most likely to incur high health costs and concomitant deterioration in health.

Models used for underwriting and models used to effect medical management may differ. Correlation coefficients (R-squared and Pearson) may be more valuable for underwriting.

Sensitivity, specificity, and positive predictive effects are essential for medical management.
Predictive Modeling Essentials

Accepts readily available information, including medical claims, pharmacy claims, and lab test results

Leverages Symmetry’s Episode Treatment Groups (ETG) to build clinically homogenous markers of future risk

Predicts both future expenditures and calculates the probability of a hospitalization

Multiple predictive horizons available based upon available data and business needs

Transparent – allows users to easily understand the clinical and utilization factors affecting a member’s risk

Characterizes members along a number of dimensions, including clinical details and gaps in care
Measuring Individual Risk

Measures of risk at the individual member level

- Demographics
- Medical Claims
- Rx Claims
- Lab Results

Symmetry Episode Treatment Groups

- Disease Prevalence, Severity
- Condition Based Risk Markers
- Service-Based Risk Markers

Episode and other groupings of inputs to support disease identification and disease severity

Grouping of Conditions into clinically homogeneous Base Risk Marker Categories

- High Acuity Events
- Moderate/ Lower Risk Markers
- Rx Markers

Patient-centered Risk Profile

- Includes Future Costs and Inpatient Stays
- 3, 12, and 18 mos. Horizons
- Key drivers of risk

Measures of Risk

Combine profile and risk results to complete member profile

Translating Markers to Predictive Risk

Apply weights measuring contribution of each marker to overall risk

Member Clinical Risk Profile

Array of markers for each member to create a transparent clinical risk profile
Risk Generation Framework

Data gathering
- Books
- Magazines
- Journals
- Clinical trails
- Healthcare protocols
- Best practice guidelines
- Systematic reviews

Quality examination of collected data
- Data cleaning, transition and consolidation

Generation of medical rules
- Rule Creation Process
- Data Warehouse
- Data Mining
- Rejected rule

Rule examination
- Rule
- Lab Test
- Drug
- Therapy
- Medical treatment
- Rule approval

Rule application
- Evidence Based Guidelines (EBG)

Rule Review Process
- Information about clinical impact of the rule
Connecting Past and Current Health with Future Risk

- Selected Medical Conditions
- Multi-Morbidity Disease Burden
- PBM data
- Prior Utilization (WMDS and claims data)

Risk Scoring

Condition Care Initiatives
Care Management
Health Services Programs
Step One – Data Inputs Used for Prediction

- Medical claims
  - diagnosis codes (ICD9/10-CM)
  - procedure codes (CPT, HCPCS)
- Pharmacy claims – NDC codes
- Demographics (age, gender, ethnicity, geography)
- Clinical data – lab results
- A 12-month “experience period” used for prediction
- Data needs – complete, consistent, valid
- Supports a range of input data scenarios
Step Two – Markers of Risk

What is a Risk Marker?

Characteristic that can be assigned to an individual and used to differentiate risk

Goal: optimize use of available inputs to create markers that are:

- Predictive
- Provide clinical insights
- Robust across populations and over time
Step Two – Markers of Risk (cont.)

Predictive models should use ETGs and other information to “optimize” use of data to create risk markers

ETG episodes of care – identify:
- clinical conditions
- levels of condition severity
- link services to those conditions

Within that context, service and treatment patterns, lab results and other information are then assessed

Result is a clinical risk profile for each individual – array of their risk markers
Example: Acute Bronchitis Episode

Clean Period
Start 60 Days

Cluster 1
Office Visit (Anchor Record)
Lab Services (Ancillary Record)
Radiology (Ancillary)
Pharmacy Records (Ancillary)

Cluster 2

Cluster 3
Clean Period
End 60 Days

Does not require the episode to be closed
Common Risk Markers

- Base and Severity
- Medical Service
- Higher-acuity events (inpatient, ER) – type and timing
  - Episode cluster markers – cluster frequency and timing
  - Pharmacy Service
- Age/Gender
- Lab Results
- Hierarchies are applied
### Marker Examples

Markers and Risk Weights for Selected Chronic Marker Families

<table>
<thead>
<tr>
<th>Marker Type</th>
<th>Diabetes</th>
<th>Ischemic Heart Disease</th>
<th>Heart Failure</th>
<th>Asthma and COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Marker</td>
<td>0.420</td>
<td>0.563</td>
<td>0.762</td>
<td>0.160</td>
</tr>
<tr>
<td>Added severity I</td>
<td>0.325</td>
<td>0.169</td>
<td>0.205</td>
<td>0.105</td>
</tr>
<tr>
<td>Added severity II</td>
<td>0.681</td>
<td>0.443</td>
<td>0.369</td>
<td></td>
</tr>
<tr>
<td>High episode clusters, recent 3 months</td>
<td>0.907</td>
<td>0.713</td>
<td>1.366</td>
<td>0.751</td>
</tr>
<tr>
<td>High episode clusters, recent 12 months</td>
<td>0.721</td>
<td>0.480</td>
<td>0.484</td>
<td>0.652</td>
</tr>
<tr>
<td>Moderate episode clusters, last 4-12 months</td>
<td>0.318</td>
<td>0.158</td>
<td>0.201</td>
<td>0.250</td>
</tr>
<tr>
<td>Emergency room visit, recent 3 months</td>
<td>0.669</td>
<td>0.364</td>
<td>1.368</td>
<td>0.185</td>
</tr>
<tr>
<td>Acute care inpatient event, recent 3 months</td>
<td>2.362</td>
<td>0.963</td>
<td>3.052</td>
<td>1.475</td>
</tr>
<tr>
<td>Acute care inpatient event, last 4-12 months</td>
<td>1.078</td>
<td>0.729</td>
<td>0.572</td>
<td></td>
</tr>
</tbody>
</table>

All members identified with a condition receive the base marker.
Some members receive added risk based on ETG and **severity** level on episode triggering the base marker.
Some members receive added risk based on acute and cluster service markers (hierarchical).
Pharmacy Marker Examples

Pharmacy services can:

**Trigger a base marker**
- Insulin
- HIV/AIDS antiviral treatment

**Differentiate risk within a marker family**
- Cardiovascular base marker, with anti-arrhythmic agents
- Cystic fibrosis, agents used to treat cystic fibrosis

**Differentiate risk in general**
- Agents to treat enzyme deficiency states
- Growth hormones
Lab Result Markers

When available, lab results can be used to supplement the other markers of risk

Types of lab markers

- Presence of an extreme lab result, e.g.,
  - Alanine aminotransferase, extreme high value, recent period
  - Cancer-125 (tumor marker), high or extreme high value, recent period

- Trend in lab results, e.g.,
  - C-reactive protein, significant increase in result
  - Albumin, significant decrease in result
Step Three – Translating Markers to Risk Measurements

- “Risk Weights” – measure a marker’s incremental contribution to risk
- Estimated from large population (about 14M for V6)
  - Statistical approach depends on model
- Each marker must have its own weight for each of the models supported by
  - Model outcome being predicted, data inputs and timing impact weight assigned to a marker
Predictive Modeling Outputs

- Individual’s markers and the risk weights are combined to produce measures of risk

- Model should provide for each individual two key risk outputs:
  - Future risk, costs
  - Future risk, inpatient use

- These key risk outputs will differ depending on model (timing, application, etc.)

- Supporting information explaining risk score is also produced
How To Interpret Weights

- A relative risk of 1.0 = the average person

- Therefore, a risk score of .70 means that the individual is only 70% as likely to use healthcare resources than the average person

- A risk score of 37.0 means that the individual is 37 times more likely to use healthcare resources as the average person
Risk Score Interpretation Example

- **Measure of future risk:**
  - “Future Risk, Costs”
  - 12 month and 3 month values

- **Translation of risk into future healthcare costs:**
  - “Future Costs”
  - $$$ for next 12 months and $$$ for next 3 months

- **Relative risk for an inpatient admission:**
  - “Future Risk, Inpatient”
  - 12 month and 3 month values

- **Probability of having a future inpatient admission:**
  - “Inpatient Stay Probability” (Max Probability is limited to 90%)
  - In the next 12 month and 3 month time horizons
Risk Scores

- Cost Risk Score – Relative risk of the member compared to other plan members with respect to utilization of medical services

- Admission Risk Score – The relative risk of this member compared to other people with respect to future, non-obstetric inpatient stays

- Inpatient Stay Probability – The probability that this member will have one or more non-obstetric inpatient stays in the next 12 months
## Risk – Prediction of Future Costs Example

<table>
<thead>
<tr>
<th>Relative Risk Score</th>
<th>Predicted Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6.412</strong></td>
<td><strong>$26,161</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Condition</th>
<th>Score</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>Diabetes</td>
<td>0.420</td>
<td>$1,714</td>
</tr>
<tr>
<td>Severity</td>
<td>Diabetes, Added Severity II</td>
<td>0.681</td>
<td>$2,728</td>
</tr>
<tr>
<td>Service</td>
<td>Inpatient stay, diabetes within recent 3 months</td>
<td>2.362</td>
<td>$9,637</td>
</tr>
<tr>
<td>Base</td>
<td>Heart Failure</td>
<td>0.762</td>
<td>$3,109</td>
</tr>
<tr>
<td>Severity</td>
<td>Heart Failure, Added Severity I</td>
<td>0.205</td>
<td>$836</td>
</tr>
<tr>
<td>Service</td>
<td>High HF episode clusters, recent 3 months</td>
<td>1.366</td>
<td>$5,573</td>
</tr>
<tr>
<td>Demographic</td>
<td>Male, 55 – 64</td>
<td>0.616</td>
<td>$2,513</td>
</tr>
</tbody>
</table>
Bring It All Together

New market requirements are driving a new definition of success

From

- Cost predictability
- Provider access
- Physician-directed information
- Employer accountability
- Standardized plan designs
- Broad industry quality metrics

To

- Cost control and affordability
- Improved health outcomes
- Product flexibility
- Consumer accountability & economic alignment
- Consumer choice, access to services
- Consumer empowerment through information

Marketplace Requirements
The Big Data = Big Win

THE SECRET OF SUCCESS IS THERE IS NO SECRET

- Proactive identification instead of reactive
- Coordinated, patient-centric care is key
- Primary care integration at every level
- Primary care provider as “quarterback”
- Correct information disparities
- Payors, clinicians, caregivers, families, patient all work together for a holistic continuum of care

Transition of care – bridging the gap between hospital discharge and primary care appointment

(Highest percentage of readmission usually occurs within the first two weeks of discharge)
Limitations

The “Impact Factor” is critical to Medical Management. Level of “impact” varies

- Diagnosis
- Psychosocial factors
- Current treatment modalities
- Asymmetrical information
- Affect of medical site utilization
- Point of care continuum
- Disease progression
- Educational/socio-economical factors
## What Distinguishes Successful Models?

<table>
<thead>
<tr>
<th>MODEL SYNTHESIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Targeting</strong></td>
</tr>
<tr>
<td>- Patients with chronic conditions including co-occurring serious mental health</td>
</tr>
<tr>
<td>diagnoses and substance abuse</td>
</tr>
<tr>
<td>- Those hospitalized in previous year or at time of enrollment</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td>- Conduct comprehensive in-home initial assessment</td>
</tr>
<tr>
<td>- Develop a mutually agreed upon “action plan” with goal</td>
</tr>
<tr>
<td>- Frequent face-to-face contact ~1/month</td>
</tr>
<tr>
<td><strong>Primary care provider</strong></td>
</tr>
<tr>
<td>- Strong rapport with primary care provider, specialist, hospital</td>
</tr>
<tr>
<td>- Face-to-face contact through co-location, regular hospital rounds, accompanying patients on physician visits</td>
</tr>
<tr>
<td>- Assign all of a physician’s patients to the same care coordinator when possible</td>
</tr>
<tr>
<td><strong>Patient Education</strong></td>
</tr>
<tr>
<td>- Provide evidence based education and coaching interventions for managing health, symptoms, and medications</td>
</tr>
<tr>
<td><strong>Training</strong></td>
</tr>
<tr>
<td>- Initial comprehensive training</td>
</tr>
<tr>
<td>- Teach-back and performance feedback</td>
</tr>
<tr>
<td><strong>Community Link</strong></td>
</tr>
<tr>
<td>- Coordinated communication among physicians, health and community providers, and patient and families</td>
</tr>
</tbody>
</table>
Best Practices

- Follow evidence based practices/guidelines for care management
- Address psychosocial issues
  - Staff with experts in social supports and community resources for patients with those needs
- Being a communications facilitator
  - Care coordinators actively facilitating communications among providers and between the patient and the providers
- Implement self management, coaching and support with patient/family
- Implement effective medication management plan
- Manage care setting transitions
  - Having a timely, comprehensive response to care setting transitions (esp. from hospitals and skilled nursing facilities)
Questions??

Steven Flores
Innovation Architect
518.419.2123
steven.flores@wellpoint.com