Applying Predictive Modeling Towards a Collaborative Practice Model

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Predictive Modeling Summit
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Opportunities for preventive care are frequently missed.

Management of chronic diseases presents unique challenges.

Greater improvement is possible.

The opportunity is to keep people healthy.
Lifestyle Challenges

- Almost half of all premature deaths are caused by lifestyle related problems.
- We can prevent many of these deaths and enhance quality of life.
- Help people to exercise regularly, eat nutritious foods, avoid tobacco and excess alcohol, learn to manage stress, enhance social networks and economic conditions, clarify lifestyle values, and achieve a sense of fulfillment in their intellectual pursuits.
Employer Concerns

- Health Care Issues
  - Control Costs Associated with Illness and Injury
  - Address Costs of Lost Productivity
  - Declining Population Health from Lifestyle Issues (obesity, tobacco, alcohol, etc.)
  - Decrease Work Site Injuries
  - Reduce Absenteeism

- Increase Consumer Knowledge
  - Benefit Design to Support Wellness
  - Member Responsibility
  - Commitment to Addressing Health Care Disparities
  - Setting an Example for the Community
Problem

- **Problem:**
  - Identifying members for care management

- **Opportunity:**
  - Create solution for care management that:
    - Identifies impactable members
      - Optimize care
      - Best opportunity to impact cost
    - Easily ranks/prioritizes members
    - Forecasts resources and events
    - Provides follow up actions
    - Integrates member information
    - Integrates into CM workflow
    - Results in ROI
Solution

- High Risk Identification
  - Catastrophic members often not high future impact

- Forecast Inpatient Days, ER Visits and Rx$
  - Individualized action plans per member

- Combine Acute Event Forecasts
  - Forecast & identify members with potential for acute care costs

- Forecast Impactable Members
  - Best opportunity for chronic care savings
  - Best opportunity to impact cost by intervening with evidence based guidelines

- Implement Forecast via Impact Index
  - Acute & Chronic Impact Index
  - Easily ranks members

- Implement into Care Management Tool
  - Detailed member profiles
• Acute

Only 30% of members with Inpatient and Emergency visits this year repeat those visits next year. Need a forecasting tool to predict acute cost.

• Chronic

For 70% of members, their chronic cost changes by less than $500 from this year to next year. Need to know what type of management will reduce those costs and which members are most impactable.
Savings Potential of Chronic Conditions

Potential Savings - Chronic $ vs. # of Gaps

- Blue line: Non-Catastrophic Conditions
- Red line: Catastrophic Conditions
**Fragmented Healthcare Delivery System**

**HealthCare Providers**
- Poor care coordination
- Limited resources

**HealthCare Data**
- Too much data, not enough insight
- Small patient volume drives majority of costs
- Fragmentation limits **real-time** information exchange

**Identify**
- Early

**Intervene**
- Effectively with **integrated** information

**Identify**
- Accurately

**Payor**
- Employer
- Physician
- Consumer

*Predictive Health™*
Predictive Models: A Functional Definition

- Use of analytic and statistical techniques applied to member-specific clinical indicators
  - Pharmacy claims data
  - Medical claims data
  - Laboratory values
  - Health risk assessment and other clinical information
- To identify members who are most likely to incur high health costs
  - Or those who are likely to incur future cost savings e.g. Impactable Members
- Models used for underwriting and models used to impact medical management may differ
Application of Predictive Models

- Identifying/managing complexly ill members (hospitalization avoidance)
- Refining disease management strategies
- Managing pharmacy services (integrated with medical management)
- Assessing physician management strategies
- Reimbursement based on illness burden
- Employer reporting requirements
- Underwriting more precisely
Predictive Models: A Framework for Success

Data Sources
- Demographics
- Patient reported info / Health Risk Assessment
- Medical Claims data
- Pharmacy Claims data
- Laboratory data

Model
- Rules-based
- Artificial Intelligence (AI)
- Blended Artificial Intelligence

Intervention
- Target Clinical Situations

Quality Improvement and Financial Impact
Predictive Modeling

Three “Artificial Intelligence” Methodologies

Rules-Based

“Blended” Artificial Intelligence

Empirical Artificial Intelligence
Blended Artificial Intelligence

- Hybrid approach
- Combines several techniques
  - Statistics
  - Machine learning
  - Artificial intelligence
Modeling Process

- Data cleanup
- Split data into 2 years
- Raw data transformed into practical indicators
- Use transformed variables from Year1 to predict Year2 cost

Raw Data

Medical Claims
- Episodes of care - *Symmetry* ETG
- Drug groupings - *First Databank*
- Proprietary clinical groupings
- Service timing/frequency Inpt/ER/Phys
- Patient characteristics
- Evidence based risk markers

Rx Claims

Member Eligibility

Optional Data
- Lab results
- HRA
- UM/Auth

Predictive Modeling Engine Forecasts

Year 2

- Total Cost
- Inpt Stay
- ER Visits
- RX Cost
Blended Artificial Intelligence

- **Advantages**
  - Open methodology, not a “Black Box”
  - Identifies anomalies and interactions
  - Eliminates over-fitting
  - Accommodates non-traditional data sources

- **Disadvantages**
  - Non-traditional process
Co-Existing Conditions

Risk (PMPY)

- $25,000
- $20,000
- $15,000
- $10,000
- $5,000
- $0

Rules-Based

- Anemia
- Nephritis
- Both Dx

AI-Based

- Anemia
- Nephritis
- Both Dx
Predictive Modeling

Key Success Drivers

- Ensure the use of clean and comprehensive data
- Incorporate more information into model
  - Quantity of more data, for more members over more years
  - Conventional data
  - Additional data (lifestyle, demographics, etc.)
- Combine analytical techniques used in traditional claims analysis
- Apply the model outputs in real-time
- Train / incent care providers to use predictive model results to support P4P initiatives
- Develop actionable intervention strategies – Guideline Gaps
Predictive Modeling: Enabling Features

- Identify prospective High Risk and High Impact members
  - Need accurate Forecasted Cost, Inpatient, ER, or $RX per member
  - Identify Movers
  - Impact Index

- Evidence based disease guideline gaps
  - Concurrent risk review
  - HEDIS, PQRI, AQA, NQF, PCPI, BTE, USPSTF measures

- Member specific actionable information

- Profiling and Reporting
  - Employers
  - Physicians
Predictive Output

- Forecasted Costs
  - Total $ for each member
  - Cost contribution by risk driver
  - Pharmacy $ for each member

- Forecasted Utilization
  - Inpatient days
  - ER visits

- Acute Impact Score
- Chronic Impact Score
Acute Impact

- Rank individuals by opportunity to avoid high cost acute care
- Reflects inpatient and ER component of overall prediction
- Assign two types of scores
  - 0-79.99: predicted inpatient days/ER visits under the top 5 percentile
  - 80-100: predicted inpatient days/ER visits in the top 5 percentile
  - Score of 97 or greater identifies patients with greatest potential for controlling acute care cost
Chronic Impact Score

- Rank individuals by future savings opportunity to reduce cost by adhering to recommended treatment guidelines
- Applies weights to gaps and gap diseases forecast savings opportunity (chronic cost opportunity)
- Assign three types of scores
  - 0: Does not have one of the chronic conditions
  - 10: Chronic condition but no savings opportunity
  - 80-100: Patients with savings opportunities
Forecasting Asthma Outcomes and Cost

- Predicted Low/ Medium/ High Cost
- Sensitivity using various data sources
  - Drug + Medical 65%
  - Drug Data Only 62%
  - Medical Data Only 61%
## Drivers for Forecasting Asthma Outcomes

### Drug Data Only
- Age
- Narcotic Analgesics
- Lipotropics
- Bronchodilators
- Asthma/Broncodil Ratio
- TotRxPaid
- DrugTotal $
- AntiMalarial
- Corticosteroids
- Psych Meds
- SkinMucousMembrane Meds
- Analgesics
- Cardiovascular Drugs
- Diuretics
- Potassium Supplements
- Antibiotics

### Add Medical Claims
- Female
- Hemoglobin a1c
- Inpatient $
- Unique BodySystem
- Nervous System Disorder
- Cellulitis
- Obesity
- Non Rx Cost
- Total Costs
## Asthma Low/Medium/High Risk Categories Comparison

<table>
<thead>
<tr>
<th>Category</th>
<th>Low Cost</th>
<th>Medium Cost</th>
<th>High Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>4</td>
<td>82</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>47%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Charges</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>$1,641</td>
<td>1</td>
<td>$43,444</td>
</tr>
<tr>
<td><strong>Total Rx $</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>$279</td>
<td>0</td>
<td>$3,771</td>
</tr>
<tr>
<td><strong>Inpt Admit</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>ER Visit</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>9%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong># Drug Claims</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td><strong>Drug Class</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td><strong>Bronchitis</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>16%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Asthma</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>64%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Bronchodilator</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Proventil, Alupent, Serevent, Theophyl, Tornalate</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>53%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Beta Short</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>32%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Ventolin, Proventil, Alupent, Brethaire Inhalers</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>38%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Inhaled Steroids</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>29%</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Aerobid, Azmacort, Beclovent Beconase, Vanceril</strong></td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>45%</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*(3,302 count)*
Patients with Chronic Conditions

## Population Analysis

<table>
<thead>
<tr>
<th>Physician Perception of Patient</th>
<th>Well</th>
<th>Sick</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Well</strong></td>
<td><strong>75%</strong></td>
<td><strong>10%</strong></td>
</tr>
<tr>
<td>“Healthy”</td>
<td>Minimal costs 3.2 visits/year</td>
<td>“Banana Peel” Avoiding costs 5.3 visits/year</td>
</tr>
<tr>
<td><strong>Sick</strong></td>
<td><strong>10%</strong></td>
<td><strong>5%</strong></td>
</tr>
<tr>
<td>“Hypochondriac”</td>
<td>Unnecessary costs 9.8 visits/year</td>
<td>“Train wrecks” High costs 9.4 visits/year</td>
</tr>
</tbody>
</table>

Patient Perception of Health vs. Well / Sick
Guideline Gaps

Opportunities to improve care

- Hypertension
- Stroke
- Depression
- Coronary artery disease
- Asthma
- High cholesterol
- Headache
- Diabetes
- Pneumonia
- Alcohol dependence

Percentage of recommended care received
## Treatment Guideline Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>Hyperlipidemia</td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td>Low Back Pain</td>
</tr>
<tr>
<td>COPD</td>
<td>Medication Management</td>
</tr>
<tr>
<td>Chronic Renal Failure</td>
<td>Migraine</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Multiple Sclerosis</td>
</tr>
<tr>
<td>Depression</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>Rheumatoid Arthritis</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Schizophrenia</td>
</tr>
<tr>
<td>High Risk Pregnancy</td>
<td>Stroke</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Preventive Maintenance</td>
</tr>
</tbody>
</table>
Prevention: A Key Aspect of Quality

- Increasing use of proven preventive services will result in fewer people suffering from diseases that could have been prevented or treated with less pain at early stages.
- Preventive services are often more cost effective than waiting to treat diseases
- Some preventive services even save more money than they cost.
- Underuse of effective preventive care is a wasted opportunity.
## Most Cost-Effective Preventive Services

<table>
<thead>
<tr>
<th>Cost Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advising at-risk adults to consider taking aspirin daily</td>
</tr>
<tr>
<td>Childhood immunizations</td>
</tr>
<tr>
<td>Pneumococcal immunization (adults 65+)</td>
</tr>
<tr>
<td>Smoking cessation advice and help to quit</td>
</tr>
<tr>
<td>Screening adults for alcohol misuse and brief counseling</td>
</tr>
<tr>
<td>Vision screening (adults 65+)</td>
</tr>
</tbody>
</table>
Cost-Effective Preventive Services

Health care services are considered “cost-effective” at less than $50,000 per quality adjusted life year.

\[
CE = \frac{\text{\$s spent} - \text{\$s saved}}{\text{QALYs saved}}
\]

<table>
<thead>
<tr>
<th>$0 to $15,000/QALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia screening (sexually active adolescents and young women)</td>
</tr>
<tr>
<td>Colorectal cancer screening (adults 50+)</td>
</tr>
<tr>
<td>Influenza immunization (adults 50+)</td>
</tr>
<tr>
<td>Pneumococcal immunization (adults 65+)</td>
</tr>
<tr>
<td>Vision screening in preschool age children</td>
</tr>
</tbody>
</table>
Care Management Goals

- With limited resources, who are the best members to manage?
- Identify High Impact Members:
  - Currently low cost yet projected high cost movers
  - High risk – inpatient & ER & Rx & total cost
  - Noncompliance - to EBM, DM guidelines
  - Impact index – high chronic or acute impact index members
Disease Management Goals

- Identify people with a specific condition projected to be very expensive next year
- Manage cost
- Avoid adverse events
- Realize immediate, short-term return with certain conditions (e.g. Asthma)
- Requires commitment for chronic conditions (e.g. Diabetes)
Predictive Management Goals

- Identify people at risk amongst those currently not identified as being at risk
- Predict those members who will have higher costs
- Promote behavioral change and enroll in Health and Wellness programs
  - Prevent disease
  - Slow progression
  - Avoid acute events
- Requires more time to slow disease progression than to prevent acute events
Care Management

Barriers:

Patient care can be fragmented and poorly coordinated.
Information is difficult to integrate as patients move from one setting to another.
Providers may lack timely and complete clinical information to assess patient needs & prevent complications.

Initiatives

- Disease Management
- Pay for Performance / Reporting
- Provider Profiling
- Decision Support
- Advanced Medical Home
Care Management

With limited resources who are the best members to manage?

Impactable members can be found by identifying:

Movers
High Risk – Inpatient & ER & RX & Total
Noncompliance – to Evidence Based Disease Guidelines
Impact Index – High Chronic Impact Index members
   (savings opportunities with adherence)
   High Acute Impact Index members
   (opportunity to avoid high cost acute care)
Addressing Physician Needs

- Single point of access that fits into the physician workflow
  - Electronic access to lab & pharmacy data
  - Access to complete patient history
  - Access to evidence based guidelines
  - Risk stratification for all patients

- Pay For Performance incentives
  - Prompt physician to intervene when patient not in compliance
  - Convert provider viewpoint from treating acute problem to longitudinal management of care
Incentive Programs

Use Predictive Modeling to:

- Identify physicians with high risk members who are not following guidelines
  - Work with these physicians one-on-one
- Empower physicians by allowing access to their member data:
  - Identify gaps in care stratified by various diseases
  - Provide member specific information
    - Member Profile
    - Risk Profile
    - Impact Profile
- E-prescribing
- Electronic health record initiatives
- Pay-for-performance / reporting initiatives
The critical step is choosing the correct members. The WHAT comes second.
Implementation

- Shift in thinking for staff
  - Historically, members referred for clinical reasons
  - Traditional “claim triggers” for disease management
  - Reactive approach

- Re-train staff to “cold-call” members who might not have a serious enough event to trigger a disease / case manager referral
  - Proactive approach
  - Requires multiple “touch” interactions with patient
  - Involves active listening
  - Objective - patient to buy into need for change
Redesign disease manager intake and operational process

Focus interventions on targeted members

Dialogue with members has to be different than old process

Use motivational interviewing techniques to get members to participate

Essential to budget the resources to train and support staff

Provide ability to follow-up if member “not ready”
Interventions Differ Over Time

- Levels of intervention may vary based on:
  - Acute events
  - Changes in function
  - New conditions
- Flexible programs adjust patient interventions to reflect interim or permanent changes in needs
- Continually assess for effectiveness or need for change
Staff Training

- Incorporate readiness to change model
  - Prochaska and DiClemente’s Stages of Change Model
  - Training on “cold calling”
  - Motivational interviewing algorithm
  - Sample scripts for stages of change
- Assess whether member is a good candidate from a non-clinical perspective
Stages of Change

FIGURE 2
Stages of change model, spiral adaptation. Adapted from Department of Health & Humans Services, Centers for Disease Control & Prevention Web site (n.d.).
Collaborative Approach to Care

- Need to engage both clinicians and consumers / patients
- Shared decision making model
- Active role of the patient in
  - understanding treatment options
  - adhering to those directives
  - being a clear part of the process

<table>
<thead>
<tr>
<th>Not All Performance Measures Are Created Equal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How much?</td>
</tr>
<tr>
<td>1. Effort</td>
</tr>
<tr>
<td>2. Outcome</td>
</tr>
</tbody>
</table>
Engage and incent members to...

- Control the cost of their own healthcare
- Adopt healthier lifestyles
- Manage chronic conditions
**Metrics**

**Clinical**
- Disease specific reductions in admits and ER visits
- HEDIS scores
- Disease specific clinical indicators

**Cost**
- PMPM costs measured by
  - Disease
  - Product
  - Location

**Operational**
- Enrollment into programs
- Customer and provider satisfaction
- Member risk levels
Objective Measurements

- Price-insensitive utilization measures to calculate financial impact
  - ER visits
  - Admissions
  - Specialist visits
- Insurance adjustments
  - Seasonal variation
  - Actuarial concepts
Standardized methods do not currently exist to determine the return on the investment in disease management programs.

What will be the estimated impact on the population overall?

- Financial impact
- Change in participant’s health
- Improvement in quality of life
- Satisfaction with process
Is the Evidence Meaningful?
ROI and Disease Management

- Medical care costs are higher when cases are more aggressively managed.
- Decreases in utilization are offset by increases in program testing and medication costs.
- Early years ROI lower due to program initiation and start-up costs.
- Early years dominated by intangible and quality returns.
- Financial returns can take 3-5 years to demonstrate.
Measurements

- Estimate trends for diseased populations (different from overall population) and what “would have been” had the program not been in place
  - Otherwise, a 10% savings from a specific disease management initiative can be obliterated by a 15% overall trend in costs
  - Trend for specific diseases is likely higher than overall population
ROI and Predictive Modeling

- Absolute savings approach in determining program success
- Measure the true population based savings received from all programs, not just a specific disease management program
Discontinuity Analysis

- Run a population through a model
- Predict group’s costs for next year
- Perform care management on the population
- Repeat the predictive model analysis
- Measure the change
- Compare to control group with no intervention
Measuring the Effect of Interventions

- **Total costs**
  - Not just disease-specific or event costs

- **Total population**
  - Not limited to high-risk, high-utilizer or enrolled participants

- Fixed, not floating, base period

- Economic adjustments to factor out external events impacting results
Evaluating Management Programs

- Stop managing healthcare costs only
- Collect aggregate population health-risk data
- Provide meaningful incentives for healthy behaviors
  - Patient
  - Provider
Predictive Modeling & Improving Health

- Before Predictive Modeling
  - Reactive after problem occurs
- After Predictive Modeling
  - Proactive
  - Early & targeted interventions
  - Focus on improving patient health
Now

- More
- Incremental change
- Reactive
- Fragmented and dispersed
- Problem oriented
- Compete on quality
- Defend status quo
- My patients/my practice

Future

- Better
- Transformative
- Systematic
- Integrated and accessible
- Electronic
- Goal directed
- Collaborate on quality
- Advocate for change
- Our community of patients
Transparency and Transformation

Transfer

More collaboration for improvement

Transparency

Trust
Health Care 2010...
Thank You!

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“Give it to me straight, Doc. How long do I have to ignore your advice?”