Predictive Modeling: a Key Tool for Decision-Making in Care Management at Johns Hopkins HealthCare

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JHHC Care Management

End Stage Renal Disease

HIV/AIDS

Guided Care

Partners with Mom

Cardiovascular/Diabetes

TeleWatch

Children with Special Needs

Behavioral Health

Substance Use

End of Life Care

Rehabilitation

Complex Medical Needs
Historical Population Case Finding

• Target diagnoses with financial prioritization
  – Total dollars
  – Medical Loss Ratio

• Referrals
  – Utilization management
  – Providers
  – Health department
  – Outreach department

• Focused committees
Motivation for Change

• Increasing Evidence that threshold-based models are inadequate for case finding and can lead to misallocation of resources, inefficiencies, and missed opportunities (Cousins MS, Shickle LM, Bander JA (2002), An introduction to predictive modeling for disease management risk stratification, Disease Management, 5(3), 157-67.)

• Evidence that Adjusted Clinical Groups Predictive Model (ACG-PM) and similar predictive models perform better than threshold-based models (ACG Virtual Library: Version 5.0 (December 2001) ACG Software Documentation/Users Manual. www.acg.jhsph.edu.
Stakeholders in the Decision to Implement ACG-PM

- Care Management Administration
- JHHC Administration
- Medical Directors
- Disease and Case Management Staff
- Finance
- Information Systems
- Decision Support
### Assessing Our Medicaid Population

<table>
<thead>
<tr>
<th>Method</th>
<th>Sensitivity or Capture Rate</th>
<th>Positive Predictive Value or Detection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Method</td>
<td>30.2%</td>
<td>24.5%</td>
</tr>
<tr>
<td>ACG-PM Method</td>
<td>42.9%</td>
<td>44.3%</td>
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</table>

Analysis was performed using ACG beta-testing version 6. CY2001 predicted enrollees were compared to CY2002 actual high cost enrollees.
Top 2% acgPM in 2001 Predicted for 2002

N=3032

N=1027

N=810

N=1344

N=1450

Financial Selection Method 2001

N=4318

N=534

N=871

N=5850

N=3131

Top 2% Actual Costs CY 2002

N=3032

N=1344

N=810

N=1450

N=4318

N=5850

N=3131
ACG-PM to Select Medicaid Enrollees with Substance Use Problems (SUP)

- All Claims for the determined time period inputted into the ACG grouper software
- ACG grouper software assigned a probability score to every enrollee that represented their probability of being in the top 5% of high utilizers in the next year(s)
- Algorithm using diagnoses and ACG-PM score used to select enrollees for intervention
Selection Algorithm

Medicaid currently enrolled, Age >= 21, geographic criteria n=14,624

Positive for substance use using ICD-9 and CPT criteria, exclusions removed n=3123

Ranking on ACG-PM Score Top 400 chosen for intervention

ACG-PM range = 0.39 to 1.00
Characteristics of the SUP/High ACG-PM Enrollees

- Compared to low-risk SUP enrollees, high-risk SUP enrollees identified by ACG-PM
  - Had higher prevalence of 52 chronic medical conditions
  - Had a higher average number of medical conditions
  - More hospital admissions
  - More hospital days
  - More ER visits
  - Higher pharmacy costs
  - Higher total Costs
High-risk SUP Enrollees had More Admissions and ED Visits than Low-risk SUP Enrollees

Admissions and Emergency Department Visits per Thousand (annualized)

\[ p < 0.001^{1,2} \]

Low-Risk \( n=1985 \)
High-Risk \( n=400 \)

1 \( p \) calculated using Mann-Whitney-U (non-parametric). Did not meet assumption of equal variances necessary for t-test.
2 \( n=1985 \) represents number of members claims data available for out of the total \( n=2085 \).
High-risk SUP Enrollees had Higher Total Costs than Low-risk SUP Enrollees

1 p calculated using Mann-Whitney-U (non-parametric). Did not meet assumption of equal variances necessary for t-test.
2 n=1985 represents number of members claims data available for out of the total n=2085.
High-risk SUP Enrollees had More Medical and Psychosocial Conditions than Low-risk SUP Enrollees

Mean Number of Medical and Psychosocial Conditions

\( p < 0.001^{1,2,3} \)

1. 52 chronic medical conditions and 7 psychological conditions were analyzed using Expanded Diagnostic Clusters (EDCs, which are part of the ACG toolkit). These conditions were chosen because of their high cost and amenability to intensive clinical intervention.

2. \( p \) calculated using Mann-Whitney-U (non-parametric). Did not meet assumption of equal variances necessary for t-test.

3. \( n=1919 \) represents number of members disease categories were assigned for out of the total \( n=2085 \).
High-risk SUP Enrollees had a Higher Prevalence of Selected High Cost Medical Conditions than Low-risk SUP Enrollees

Disease Prevalence of Selected Medical Conditions
\( p < 0.001^{1,2,3} \)

152 chronic medical conditions and 7 psychological conditions using Expanded Diagnostic Clusters (EDCs, which are part of the ACG toolkit). These conditions were chosen because of their high cost and amenability to intensive clinical intervention

\(^2\) p calculated using chi-square

\(^3\) n=1919 represents number of members disease categories were assigned for out of the total n=2085.
Integrating ACG-PM into Daily Operations

- Intensive staff education
- Disseminating information
- Disease management database enhancements
- Clinical screener role
- Clinical screener toolkit
Database Enhancements
Database Enhancements
Clinical Screener: A New Nursing Role

- Registered Nurse
- Managed care and clinical experience
- Proactive screening of enrollees identified by ACG-PM as potential high utilizers
- Continued referral screening
- Assessment and program referral
Clinical Screener Toolkit

- ACG-PM: Predictive Modeling
- Diagnoses
- Utilization
- Clinical indicators: lab and radiology results
- Clinical assessment: telephone contact
- Disease/case management amenability assessment
ACG Lookup Database
### ACG Lookup Database

<table>
<thead>
<tr>
<th>Pd Begin</th>
<th>Pd End</th>
<th>PCP</th>
<th>Aid Code</th>
<th>Aid Code Desc</th>
<th>County</th>
<th>Zip</th>
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<tbody>
<tr>
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<td>12/31/2002</td>
<td>CHASE BREXTON HEALTH SERVICE</td>
<td>BC316</td>
<td>SSI</td>
<td>BALTIMORE CITY, MD</td>
<td>21229</td>
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<td>EC011</td>
<td>SSI</td>
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### Priority Partners ACG Lookup

<table>
<thead>
<tr>
<th>Pd Begin</th>
<th>Pd End</th>
<th>Major EDC</th>
<th>MEp Concrete</th>
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<tr>
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<td>12/31/2004</td>
<td>END</td>
<td>Endocrine</td>
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<td>1/1/2004</td>
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<td>GSU</td>
<td>General Surgery</td>
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<td>INF</td>
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<td>1/1/2004</td>
<td>12/31/2004</td>
<td>MUS</td>
<td>Musculoskeletal</td>
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<td>1/1/2004</td>
<td>12/31/2004</td>
<td>NUR</td>
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<td>Psychological</td>
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<td>SKN</td>
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<td>1/1/2004</td>
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**EDC Details**

<table>
<thead>
<tr>
<th>EDC Code</th>
<th>EDC Desc</th>
</tr>
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<tbody>
<tr>
<td>PSY01</td>
<td>Anxiety, Neuroses</td>
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<tr>
<td>PSY02</td>
<td>Substance Use</td>
</tr>
<tr>
<td>PSY05</td>
<td>Family and Social Problems</td>
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</table>
Referral from Screener to Disease/Case Manager

Member Contacted: Yes
Member Consent to CM: Yes
AggPM Score: 0.94

EDC Descriptors:
car03 - Ischemic Heart Disease (excl AMI)
car05 - Congestive Heart Failure
car06 - Cardiac Valve Disorders
car07 - Cardiomyopathy
car09 - Cardiac Arrhythmia
car10 - Generalized Atherosclerosis
car11 - Disorders of Lipid Metabolism
car12 - AMI
gsv1 - Peripheral Vascular Disease
nur05 - Cerebrovascular Disease
res04 - Emphysema, Chronic Bronchitis, COPD

Date Member Contacted: 1/11/2005
IP Utilization:
multiple admits and OP surgical procedures for wound debridement. See IDX for clinical details.

ED Utilization:
1 ER visit for swollen legs in 7-04.

Member Referred to: Complex Medical Team
Date Referred: 1/11/2005
General Comments:

Referral Source Notified: Yes
Referral from Screener to Disease/Case Manager

Yale Social Isolation Responses:

1. Are you married?  Divorced, Widowed, Never married
2. Who were you living with before you came/went to the hospital?  Lives alone
3. Is there someone you can count on for help and support when you need it?  Yes, 1 or more local adults
4. Emergency contact status:  Yes, emergency contact name/number given or listed in medical record WITHIN 410 area code

YSI Comments:
Member lives alone but has a daughter who visits daily.

Instrumental Activities of Daily Living Responses:

Q1. Because of a health or physical problem, how much difficulty do you have doing these activities without the assistance of another person or a special device:

A. Bathing  Some difficulty  H. Doing housework  A lot of difficulty
B. Dressing  Some difficulty  I. Taking medications  Some difficulty
C. Eating  Some difficulty  J. Getting to places beyond walking distance  A lot of difficulty
D. Getting in or out of chairs  Some difficulty  K. Preparing your own meals  Some difficulty
E. Walking across a small room  A lot of difficulty  L. Shopping  A lot of difficulty
F. Using the toilet  Some difficulty  M. Managing money like keeping track of expenses or paying bills  Some difficulty
G. Using the telephone  Some difficulty
Referral from Screener to Disease/Case Manager

Q2. In the past 6 months, how many days did you stay in bed for more than one-half day because of illness or injury? 10

Q3. In the past 6 months, not counting the days you spent in bed, how many days did you cut down on things you usually do because of illness or injury? 50

Q4. On a Scale of 0 (No Burden at all) to 5 (Very High Burden), How great a BURDEN is:

A. Taking Medications as Recommended 2
B. Visiting Health Care Providers 4
C. Following Dietary Recommendations 3
D. Following Exercise Recommendations N/A

Q5. On a Scale of 0 (Not Confusing at all) to 5 (Very Confusing), How CONFUSING is:

A. Taking Medications as Recommended 1
B. Visiting Health Care Providers 1
C. Following Dietary Recommendations 2
D. Following Exercise Recommendations N/A

Q6. Many people cannot do everything their health care providers recommend. How often do you:

A. Take your medications as recommended 4 - Most of the time
B. Keep your health care appointments 4 - Most of the time
C. Follow exercise recommendations N/A
D. Follow dietary recommendations 2 - Sometimes
In Summary…

• Predictive Modeling
  – An important part of an overall strategy
    • One of many screening tools
  – Improves CM and DM targeting
    • Our research shows that predictive model does identify high-risk cases amenable to Care Management interventions
  – Must be employed with appropriately educated staff
    • Clinical Screener Role
    • Disease and Case Managers must understand output of predictive models
Future Directions….

• Children with Special Health Care Needs
  – Performance of model with children
  – Part of a screening strategy that would include instruments that are sensitive to children and families

• HIV/AIDS population
  – Performance of model
  – Part of a screening strategy