Predictive Modeling for ACOs

December 2013
Agenda

• Introductions

• Walgreens Mission and Vision

• Walgreens ACO predictive models

• Predictive models for End-of-Life
Introductions

Ian Duncan FSA FIA FCIA MAAA. Vice President, Clinical Outcomes & Analytics and Head of Research, Walgreen Co. Chicago. Adjunct Professor at UC Santa Barbara and Adjunct Research Professor, Georgetown Dept. of Health Administration.

Board member, Massachusetts Health Insurance Connector Authority (Exchange).

Author of several books and peer-reviewed studies in healthcare management and predictive modeling. 2011 publication has chapter on Massachusetts Reform.

Published 2008
New Edition December 2013

May 2011
Walgreens mission and vision

MISSION
To be the most trusted, convenient, multi channel provider/advisor of innovative pharmacy, health and wellness solutions, and consumer goods and services in communities across America.
A destination where health and happiness come together to help people get well, stay well, and live well.

VISION
To be “My Walgreens” for everyone in America, the first choice for health and daily living
Walgreens has a multichannel, national footprint with a local presence

Nearly $\frac{2}{3}$ of the US population live within 3 miles of a Walgreens

Transforming community pharmacy into an integrated healthcare delivery system

• A premier provider of healthcare and wellness services
• 75,000 affiliated healthcare providers deliver high-quality healthcare services
  – Retail and specialty pharmacists
  – RNs, LPNs, NPs, PAs
  – Dietitians
  – Health and wellness coaches
  – Health and fitness trainers
  – Case managers and referral assistance
Healthcare Retail Clinic Locations

- Open 7 days a week with 360+ locations in 31 markets, 19 states
- Online appointment scheduling available

Covered lives data supplied by Health Leaders as of January 2012. Data include fully insured lives plus self insured lives.

©2013 Walgreen Co. All rights reserved. Confidential and proprietary; should not be reproduced or redistributed.
Moving into the future: Walgreens Well Experience

250+ Well Experience stores brings primary healthcare services front and center.
Accountable Care Services: Targeted, Coordinated and Connected

Consumer Centered Care at Walgreens
- Medication Therapy Management
- Inpatient bedside Rx Delivery
- Inpatient discharge solutions- WellTransitions™
- Health Screenings
- Adherence counseling
- HIV centers of excellence
- Broad access to specialty medications
- Infusion and Respiratory Services

Physician Support in and network enhancement
- Patient referrals
- Comprehensive Medicare Member Assessments coding support
- Medicare Wellness exams screen consumers for office visits
- Gap Closure
- Site of care optimization
- Consumer engagement programs
- Physician education and alignment materials
- Adherence reporting- MedGap Analysis™
- Targeted Health Resource Panel Messaging

Back office data and analytics
- Direct reporting of consumer interventions from
  - Immunizations
  - Health testing
  - Infusion and Respiratory Services
  - Healthcare Centers
  - Gap Closure
- Analytics and predictive modeling support for gap closure and targeted high risk populations

©2013 Walgreen Co. All rights reserved. Confidential and proprietary; should not be re-produced or re-distributed.
Walgreens ACO Predictive Models

December 2013
The Challenge for ACOs

Mr Micawber's famous, and oft-quoted, recipe for happiness:
"Annual income twenty pounds, annual expenditure nineteen pounds nineteen shillings and sixpence, result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery."

Charles Dickens, *David Copperfield*
Providers are not good at predicting re-admission risk

Assessed the predictions made by
- Physicians
- Case managers
- Nurses

“...none of the AUC values were statistically different from chance”

Current Predictive Models aren’t much better

“Most current readmission risk prediction models perform poorly…Efforts to improve their performance are needed.”

Implications
A single, nationwide model is unfeasible
Additional data points may improve predictive accuracy – possibly including pharmacy data

Members were classified into 8 hierarchical categories:

- Nearly 25% of members do not have an identified acute, chronic or mental health condition.
- 35.3% of the <65 segment do not have an identified condition.

<table>
<thead>
<tr>
<th>Condition</th>
<th>&lt;65</th>
<th>65+</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Acute MH Chronic</td>
<td>11.0%</td>
<td>11.9%</td>
<td>11.7%</td>
</tr>
<tr>
<td>2) Acute MH</td>
<td>5.8%</td>
<td>3.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td>3) Acute Chronic</td>
<td>7.3%</td>
<td>17.6%</td>
<td>15.2%</td>
</tr>
<tr>
<td>4) Acute Only</td>
<td>6.5%</td>
<td>9.1%</td>
<td>8.5%</td>
</tr>
<tr>
<td>5) MH Chronic</td>
<td>7.8%</td>
<td>4.3%</td>
<td>5.1%</td>
</tr>
<tr>
<td>6) MH Only</td>
<td>10.3%</td>
<td>3.9%</td>
<td>5.4%</td>
</tr>
<tr>
<td>7) Chronic Only</td>
<td>8.8%</td>
<td>15.7%</td>
<td>14.1%</td>
</tr>
<tr>
<td>8) EHC</td>
<td>7.2%</td>
<td>13.8%</td>
<td>12.2%</td>
</tr>
<tr>
<td>No Condition</td>
<td>35.3%</td>
<td>19.9%</td>
<td>23.6%</td>
</tr>
</tbody>
</table>
When focusing on costs...

- More than $4 of every $10 dollars is spent on most complex members.
- Acute members with chronic and mental health comorbidities account for nearly 76% of all spend – care management is critical for these members.

### Overall cost distribution by condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>&lt;65</th>
<th>65+</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Acute MH Chronic</td>
<td>46.8%</td>
<td>41.3%</td>
<td>42.3%</td>
</tr>
<tr>
<td>2) Acute MH</td>
<td>10.8%</td>
<td>5.9%</td>
<td>6.8%</td>
</tr>
<tr>
<td>3) Acute Chronic</td>
<td>16.2%</td>
<td>29.2%</td>
<td>26.8%</td>
</tr>
<tr>
<td>4) Acute Only</td>
<td>6.2%</td>
<td>7.1%</td>
<td>6.9%</td>
</tr>
<tr>
<td>5) MH Chronic</td>
<td>8.0%</td>
<td>3.7%</td>
<td>4.4%</td>
</tr>
<tr>
<td>6) MH Only</td>
<td>5.5%</td>
<td>1.8%</td>
<td>2.4%</td>
</tr>
<tr>
<td>7) Chronic Only</td>
<td>3.9%</td>
<td>6.7%</td>
<td>6.2%</td>
</tr>
<tr>
<td>8) EHC</td>
<td>1.9%</td>
<td>3.6%</td>
<td>3.3%</td>
</tr>
<tr>
<td>No Condition</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>
Distribution for Aged and Disabled Population

Comparison between <65 members and >65 population.

**Under 65 Population**

- Acute MH Chronic: 11.0%
- Acute MH: 7.3%
- Acute Chronic: 6.5%
- Acute Only: 7.8%
- MH Chronic: 10.3%
- MH Only: 8.8%
- Chronic Only: 7.2%
- EHC: 16.2%
- No Condition: 35.3%
- Costs: 46.8%

**Over 65 Population**

- Acute MH Chronic: 11.9%
- Acute MH: 17.6%
- Acute Chronic: 9.1%
- Acute Only: 4.3%
- MH Chronic: 15.7%
- MH Only: 3.9%
- Chronic Only: 13.8%
- EHC: 7.1%
- No Condition: 19.9%
- Costs: 41.3%

**Comparison**

- Under 65: 11.0% Acute MH Chronic, 7.3% Acute MH, 6.5% Acute Chronic, 7.8% Acute Only, 10.3% MH Chronic, 8.8% MH Only, 7.2% Chronic Only, 16.2% EHC, 35.3% No Condition
- Over 65: 11.9% Acute MH Chronic, 17.6% Acute MH, 9.1% Acute Chronic, 4.3% Acute Only, 15.7% MH Chronic, 3.9% MH Only, 13.8% Chronic Only, 7.1% EHC, 19.9% No Condition

**Membership Costs**

- Under 65: 46.8%
- Over 65: 41.3%
Overview - How do the aims of the ACO drive strategy?

4x Aims of the ACO

↑ Patient experience
↑ Health
↓ Administrative burden
↓ Cost

ACO Strategies

1. Clinical Programs
   - (a) EOL
   - (b) Transitions
   - (c) ACS
   - (d) PST
   - (e) CKD
   - (f) Somatization

2. Gaps in Care
   - Based on 33 quality measures
   - Others in support of clinical programs:
     - Screening tests
     - Drug dose modification
     - Biometrics
     - Immunization
     - Adherence

©2013 Walgreen Co. All rights reserved.
Overview – Clinical Programs

(a) Prevent over-medicalized End-Of-Life (EOL) care.
(b) Prevent unplanned Transitions in care.
(c) Prevent Ambulatory-Care-Sensitive (ACS) hospitalizations.*
(d) Improve decision-making for Preference-Sensitive Treatments (PST).
(e) Prevent over-medicalization of Chronic Kidney Disease (CKD).
(f) Prevent Somatization - over-investigation of medically unexplained symptoms.

*especially for patients with a combination of acute + chronic + mental health issues.
Overview - The Role of Analytics

Analytics supports the goals of the ACO through the following processes:

1. Conducting opportunity analysis to identify (and then quantify) potential clinical programs;
2. Aggregating and warehousing data from multiple sources;
3. Predictive modeling/risk stratifying at the patient level for implementation of clinical programs;
4. Identifying gaps in care at the patient level;
5. Developing baseline quality measures for outcomes reporting (33 quality measures);
6. Providing ongoing reporting for program management and outcomes.
Overview – The Value of Predictive Modeling

• Assists providers by stratifying patients and focusing resources; it is not a substitute for clinical judgment.

• Harnesses the power of healthcare data, including CMS data that providers do not have.

• Focuses ACO clinical programs on the portion of the patient population with the greatest potential for improved outcomes (Triple Aim).

• Focuses resources where they will have the greatest impact.

• Increases efficiency and impact of clinical programs.
Overview – Predictive Modeling Defined

Predictive models stratify the patient population according to their likelihood of experiencing the target event. The process includes:

1. Using a similar dataset, identify all potentially correlated independent variables that predict the dependent (outcome) variable.
2. Derive scores for each patient (i.e. likelihood of experiencing the event) under numerous combinations of variables.
3. Compare the actual outcomes to the scores, to determine the scenario with the best positive predictive value. (PPV)
4. Operationalize the method for application to actual ACO data.

Develop a program to manage the targeted members.
Preventing over-medicalized End-Of-Life care
There is not a significant difference between the experience of members with a hospice stay and those without (65+).

<table>
<thead>
<tr>
<th></th>
<th>END OF LIFE - HOSPICE</th>
<th>END OF LIFE - NON-HOSPICE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 65</td>
<td>65 +</td>
</tr>
<tr>
<td>Average Lives</td>
<td>1,035</td>
<td>15,091</td>
</tr>
<tr>
<td>% of Overall</td>
<td>0.1%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Total Allowed</td>
<td>$ 7,322</td>
<td>$ 5,826</td>
</tr>
<tr>
<td>% of Overall</td>
<td>1.5%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

• Note: these lives represent 6 months of deaths; to derive the annual total double the prevalence.

• These numbers represent 6 months of claims. To derive the last 12 months of claims, multiply by 3.0.
The most complex members are a significant portion of the end-of-life population, and total cost.

<table>
<thead>
<tr>
<th>Members</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 65</td>
<td>65 +</td>
</tr>
<tr>
<td>&lt; 65</td>
<td>62.2%</td>
</tr>
<tr>
<td>65 +</td>
<td>60.1%</td>
</tr>
<tr>
<td>ALL</td>
<td></td>
</tr>
<tr>
<td>HOSPICE</td>
<td></td>
</tr>
<tr>
<td>43.8%</td>
<td>50.4%</td>
</tr>
<tr>
<td>56.2%</td>
<td>59.8%</td>
</tr>
<tr>
<td>NON-HOSPICE</td>
<td></td>
</tr>
<tr>
<td>56.2%</td>
<td>58.9%</td>
</tr>
<tr>
<td>65.5%</td>
<td>61.2%</td>
</tr>
</tbody>
</table>

Overall, close to 60% of end-of-life costs are generated by the most complex patients; because end-of-life accounts for 23% of all costs, the complex patients generate about 14% of all costs.
The most complex members: Comparative Utilization.

Complex end of life patients have a high frequency of hospital admissions (2500 per 1000). Most of these are for medical DRGs. Also very high specialist visit frequency.

Under 65 patients are an even high-utilizing group.
Preventing over-medicalized **End-Of-Life** care

### Clinical Program:
- Education for physicians and their staff on how to instigate end-of-life conversations.  
- Program to encourage patients to complete advance directives, consisting of materials, a helpline, and a registry.
- Patient access to hospice and palliative care.
- Symptom-focused case management for very high-risk patients.

<table>
<thead>
<tr>
<th></th>
<th>↑ Population health</th>
<th>↓ Administrative burden</th>
<th>↓ Per capita cost</th>
<th>↑ Patient experience</th>
</tr>
</thead>
</table>
| Reduction in inappropriate life-sustaining treatments within 6 months of death, including a reduction in ER visits.  
  2 | Dedicated case managers to support physicians in caring for complex patients that are at very high risk of over-medicalized end-of-life care as defined by Barnato et al.  
  2 | Home-hospice care associated with significantly lower average costs ($12,434 versus $4,761 per year in 2007 dollars).  
  5 | Patients receiving in-home palliative care report significantly higher satisfaction and quality of life.  
  6 |

---

End of Life Predictive Model - Definition

Over-medicalized death is defined as:

- Chemotherapy for cancer patients within 14 days of death;
- Unplanned hospitalization within 30 days of death;
- More than one emergency department (ED) visit within 30 days of death
- ICU admission within 30 days of death; or
- Life-sustaining treatment within 30 days of death.

End of Life Predictive Model - Scoring

- An EOL risk score is calculated for each member.
- Risk scores range in value from 0.0-1.0.
- Model is based on the following member attributes (121 in all):
  - Age and gender;
  - Race;
  - Region
  - Clinical Grouper Flags (65 HCCs);
  - Baseline admission count(s)
  - Baseline readmission count(s)
  - Baseline ER visit count(s)
  - Baseline admission via ER indicator
  - Baseline dollars spent for healthcare resources
End of Life Predictive Model – Conditions and Attributes that Add Most to Scores

1. Acute Myocardial Infarction
2. Acute Leukemia
3. Craniotomy with major device implant
4. Cardio-Respiratory Failure & Shock
5. Metastatic Cancer & Acute Leukemia
6. Lung, Upper Digestive Tract and Other Severe Cancers
7. Septicemia or Severe Sepsis
8. Number of Admissions
## End of Life Predictive Model – Opportunity as seen from Medicare 5% Database

<table>
<thead>
<tr>
<th>Categories</th>
<th>Members</th>
<th>% of Total Population</th>
<th>PMPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survivors</td>
<td>819,189</td>
<td>92.0%</td>
<td>$684.80</td>
</tr>
<tr>
<td>Deceased</td>
<td>71,059</td>
<td>8.0%</td>
<td>$4,323.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate</td>
<td>22,989</td>
<td>2.6%</td>
<td>$2,249.62</td>
</tr>
<tr>
<td>Inappropriate</td>
<td>9,832</td>
<td>1.1%</td>
<td>$3,433.30</td>
</tr>
<tr>
<td>OverMedicalized</td>
<td>38,238</td>
<td>4.3%</td>
<td>$5,797.08</td>
</tr>
<tr>
<td>Total</td>
<td>890,248</td>
<td>100.0%</td>
<td>$975.26</td>
</tr>
</tbody>
</table>

The difference between over-medicalized and appropriate death represents a financial and clinical opportunity. (Inappropriate death also represents an opportunity, although a smaller one).
End of Life Predictive Model – Member costs by category and risk score

The PMPMs for members in each category vary across the bands of risk scores. The difference in the costs between those that experience overmedicalized deaths versus those that experience appropriate deaths is greatest in members with risk scores >.95.
Out of a 10,000 attributed life group, we would expect 430 overmedicalized deaths (4.3%). Based on our model, approximately 46% of these members will have risk scores > .95.
Out of a 10,000 attributed life group, we would expect 341 members to have risk scores > .95. Of these members, we expect 197 (57.9%) to be “true positives”; that is, these are the members that represent an opportunity to avoid an overmedicalized death.
End of Life Predictive Model - Targeting

Focusing on members with risk scores >.95 allows us to target our resources on only 3.4% of the population in order to “find” nearly half of the members that represent our opportunity.
End of Life Predictive Model - Targeting

The risk score “cut off” point is determined by evaluating the number of total members above a given risk score with the number of “true positives” found in that group. We will incur intervention costs on all members with risk scores above the cut-off, but only have the opportunity to generate savings on the “true positives” within that group.

Total OM Deaths (430 of 10,000)

Remaining OM Deaths (232)

True Positives (197)

False Positives (143)

Opportunity for Savings Thru Effective Interventions

The risk score “cut off” point is determined by evaluating the number of total members above a given risk score with the number of “true positives” found in that group. We will incur intervention costs on all members with risk scores above the cut-off, but only have the opportunity to generate savings on the “true positives” within that group.
## End of Life Predictive Model - Financial Scenario at 95% Risk Score Threshold

<table>
<thead>
<tr>
<th>Based on Members with Risk Scores &gt;.95</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Members (out of 10,000)</td>
</tr>
<tr>
<td>% of Members (out of 10,000)</td>
</tr>
<tr>
<td>Over Medicalized Sensitivity</td>
</tr>
<tr>
<td>PPV (OM Deaths)</td>
</tr>
<tr>
<td># of True Positives (out of 10,000)</td>
</tr>
<tr>
<td># of False Positives (out of 10,000)</td>
</tr>
</tbody>
</table>

## Estimated Gross Savings

| # of True Positives (a)               | 197 |
| Engagement Rate (b)                  | 40% |
| Effectiveness Rate (c)               | 50% |
| Potential Savings per True Positive (d), (1) | $15,981 |
| Estimated Gross Savings (a x b x c x d) | $630,853 |

## Estimated Net Savings

| # of Members with p>.95 (e)          | 341 |
| Engagement Rate (b)                 | 0%  |
| Cost of Case Management (f)         | $940.67 |
| Total Cost (e x b x f)              | $128,234 |
| Net Savings/(Costs)                 | $502,619 |

(1) Difference in costs between OM death and appropriate death, over 6.5 months (PMPM*6.5).
Operationalizing the End of Life Predictive Model

Process:

- Analytics team will apply EOL Predictive Model to the warehoused data after each month’s additions to the data.

- Analytics team will produce list of members at high risk for an over-medicalized death within the next 6-12 months. (monthly report)

- Clinical team and providers will target the identified members for application of the components of the EOL Clinical Program, for example:
  - Advanced Directives
  - Access to Hospice and Palliative Care
  - Complex-case Management
Clinical Outcomes & Reporting
Ian Duncan FSA FIA FCIA MAAA
Vice President
ian.duncan@walgreens.com
(847) 964-6418
1415 Lake Cook Rd. / 4S / MS #L444
Deerfield, IL  60015
Walgreens

The power of a national footprint with the reassurance of a personalized, local presence.