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Current Issues in Predictive Modeling for Case Management

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Three Current Issues

- Working with special populations -- predicting the future risk for behavioral health patients
- Measuring success -- evaluating the impact and return on an investment in predictive modeling
- Looking beyond the top 1% of risk to find actionable patients and interventions

Managing Disease Populations: Predictive Modeling for Behavioral Health and Substance Abuse

Predicting Risk for BHSA

Challenges and Value

- Managing patients with behavioral health and substance abuse (BHSA) disorders can be an important component of a health management strategy – for both commercial and Medicaid populations
- BHSA drives a significant component of medical costs – both in terms of patients with significant BHSA disorders, as well as chronic and other disease patients with one or more BHSA co-morbidities.
- As a practical need, many organizations “carve-out” BHSA care and require risk predictions to support contracting and care management.
- Standard approaches to risk prediction using “all-disease” models will not reflect well the needs of these populations and their future cost and utilization. An alternative, condition-specific approach is required.

Predicting Risk for BHSA

Business Needs

- Accurate predictions of the costs and utilization related to diagnosing, managing and treating BHSA disorders.
- Information to support care interventions for BHSA patients, including their key drivers of risk, clinical profile and gaps in care.
- A complete solution requires:
 - Risk prediction – predicting BHSA-related costs
 - Clinical Indicators – markers of clinical conditions, BHSA and other
 - Care opportunities – observed gaps between the care delivered to a patient and that prescribed by research-based evidence and guidelines
- This presentation focuses on the estimation of risk

Predicting Risk for BHSA

Risk outcome to be predicted

- Relative risk of future costs related to Behavioral Health and Substance Abuse (BHSA) – services involved in the diagnosis, management and treatment of BHSA conditions
- BHSA costs defined as the cost of medical and pharmacy services grouped into Psychiatry and Substance Abuse ETG* “episodes of care”

*Symmetry Episode Treatment Groups (ETG) is a methodology that identifies unique clinical conditions for a patient and the services related to each particular condition – the result is one or more clinically-relevant episodes of care.

Predicting Risk for BHSA

Risk outcome to be predicted (cont)

- Episodes used in defining BHSA-related services

Mood disorders, depression

Mood disorders, bipolar

Dementia

Organic drug/metabolic disorder

Autism & child psychoses

Psychoses & schizophrenia disorder

Personality disorder

Eating disorder

Anxiety disorders or phobias, minor

Psychosexual disorder

Attention deficit disorder

Development disorder

Somatoform disorder

Mental retardation, mild

Other mental disorder

Psychiatric disease S&S

Cocaine or amphetamine dependence

Acute alcohol intoxication

Alcohol dependence

Opioid or barbituate dependence

Other drug dependence

Predicting Risk for BHSA

General approach to prediction

- Use experience for an individual for a 12-month period to predict relative BHSA costs for the following 12-month period
- Apply algorithms to the medical and pharmacy experience to generate “markers of risk” – using observed patient episodes of care and other logic
- The markers of risk describe the presence of a unique BHSA or physical condition and utilization and severity markers indicating added risk related to that condition

Predicting Risk for BHSA

General approach to prediction (cont)

- Each risk marker is assigned a “risk weight”
- Weights describe the incremental contribution to risk of having a marker
- Risk score for a member is the sum of the risk weights for all of the markers that they trigger

Predicting Risk for BHSA – Methods

- Risk markers
 - Leveraged Ingenix Impact Pro 6.0 risk marker set
 - Identified those markers important to the prediction of BHSA risk (188 total markers)
- Risk weights
 - Weights estimated using multiple linear regression
 - BHSA medical and pharmacy costs PMPM (Year 2) as the dependent variable, risk markers observed from prior member experience (Year 1) as the independent variables
- Data
 - Commercial population – non-elderly, 3.6m members, 2006-2007.
 - Stats:
 - Mean age: 35.4 years; 51% female
 - Mean 2007 cost PMPM: Total \$369; BHSA \$27

Predicting Risk for BHSA

- Risk markers and weights for BHSA Model (examples):

Risk Marker	Prevalence	% Prevalence	Risk Weight
Mood disorder, bipolar, base marker	18,805	0.52%	1.05
Mood disorder, bipolar, significant clusters, recent period	5,052	0.14%	10.49
Mood disorder, bipolar, significant clusters, earlier period	6,038	0.17%	6.52
Mood disorder, bipolar, moderate clusters, earlier period	4,031	0.11%	1.56
Mood disorder, bipolar, ER, recent period	156	0.00%	7.25
Mood disorder, bipolar, inpatient stay, recent period	662	0.02%	34.77
Mood disorder, bipolar, inpatient stay, earlier period	1,358	0.04%	15.67
Mood disorder, bipolar, added severity level	5,109	0.14%	1.80
Mood disorder, bipolar, w selected BH Rx agents, 3 or more	1,973	0.05%	2.16
Mood disorder, bipolar, w selected BH Rx agents, 6 or more	13,296	0.36%	10.52

Predicting Risk for BHSA

- Risk markers and weights for BHSA Model (examples):

Risk Marker	Prevalence	% Prevalence	Risk Weight
Anxiety disorder or phobias, minor, base marker	72,725	2.01%	0.83
Anxiety disorder or phobias, minor, significant clusters, recent period	6,812	0.19%	5.47
Anxiety disorder or phobias, minor, significant clusters, earlier period	8,912	0.25%	4.24
Anxiety disorder or phobias, minor, w select BH Rx agents, 3 or more	322	0.01%	1.44
Anxiety disorder or phobias, minor, w select BH Rx agents, 6 or more	411	0.01%	5.00
Diabetes, inpatient stay, recent period	754	0.02%	0.45
Nutritional deficiency and dehydration, signific clusters, recent period	443	0.01%	5.25
Migraine headache, significant clusters, recent period	662	0.02%	2.00
Parkinson's disease, base marker	3,081	0.09%	1.63
Alzheimer's disease, base marker	2,133	0.06%	1.03

Predicting Risk for BHSA

Example

Markers of Patient Risk		Relative Risk Weight
Disease/Condition	Mood disorder, depression, (base marker)	1.05
Service Marker	Inpatient Stay, mood disorder, depression, primary within recent 3 months	34.77
Disease/Condition	Diabetes, (base marker)	0.10
Service Cluster	Significant diabetes episode clusters, recent 3 months	0.42
Disease/Condition	Alzheimer's disease, (base marker)	1.03
Pharmaceutical	Mood disorder, bipolar, w sel BH Rx agents, 6 or more	10.52
Demographics	Male, 55 to 64	0.15
Total		48.04

Interpretation – future BHSA costs for the patient is expected to be more than 40 times that of the average enrolled member.

Predicting Risk for BHSA – Comments

- Risk markers and weights
 - BHSA conditions represented the large majority of risk markers identified – and carried the greatest amount of risk weight
 - BHSA condition-related utilization markers (inpatient stays, ER, clusters, and pharmacy treatment) were most useful – carrying the greatest weight in each condition “family” or markers
 - Some physical conditions contributed to the model – selected chronic conditions, cancers, and neurological conditions. The contribution of physical condition markers was minimal relative to BHSA-related markers
 - Model weights were robust when tested across different subsets of the development data

Predicting Risk for BHSA – How well did we do?

Model Accuracy (using a test population):

- Individual adjusted r-squared: 0.26
- Specificity: 98-99%
- PPV: % of members by risk in top Yr 2 cost %

Members with Highest Risk	% In Highest Threshold Future BHSA Costs		
	Top 1%	Top 2%	Top 5%
Top 0.5%	48	68	86
Top 1%	37	59	84
Top 2%	26	47	76
Top 5%	14	28	57

Predicting Risk for BHSA – How well did we do?

Model Accuracy:

- % of Year 2 BHSA Cost Covered by Higher Risk Strata:

% of Future BHSA Cost Covered by Selected Population	Top Percent of Population based on Future BHSA Risk												
	0.5	1	2	3	4	5	6	7	8	9	10	15	20
All Members	15%	24%	36%	45%	51%	56%	61%	64%	67%	69%	71%	79%	83%
Age 0-17	18%	27%	39%	47%	53%	57%	61%	65%	68%	70%	71%	75%	77%
Age 18+	15%	23%	35%	44%	51%	56%	60%	64%	67%	69%	71%	79%	84%

Interpretation – the top 5% of members, based on BHSA risk score, consumed 56% of total BHSA-related costs across the entire test population. The top 10% consumed 71%.

Measuring Success:

A Case Study in Using Predictive Modeling to Improve Productivity and Achieve Savings in Case Management

WEA Trust: Not for profit insurer serving public school employees and dependents

Challenges:

- Need staff to spend less time mining data
- Poor staff efficiency due to outsourcing of some parts of case management
- Managed with “homegrown” tools
- Needed to better understand drivers of utilization and ways to improve health and reduce costs

Seeking a Solution that Would:

- Help identify at-risk populations
- Offer up to date information and reports
- Provide a central source of information for all health data
- Offer transparency down to the patient level

Solution-A Predictive Modeling Tool that:

- Easy to use
- Robust predictive modeling
- Transparent and modifiable rules
- Predictive modeling identifies
 - Those with opportunities for improved care based on evidence based care profiles
 - Those populations predicted to incur the greatest cost

Results

- Increase in the efficiency of care managers
- Reduction in analysis costs
- Elimination of homegrown systems and outside consultants
- Improvement in adherence to quality standards
- Reports are refreshed monthly so that WEA Trust can intervene with members at the appropriate time

By the Numbers

- 10% increase in the number of eligible members who have enrolled in care management programs
- Reduced the number of false positives by 50% through improved identification
- Increased the number of new cases per month per care manager from 6.5 to 14.5
- Average case completion rate has gone from 24.6 per month to 37 per month.

Bottom Line: Significant Savings

- **Return on Investment of 68%**
- **Payback Period of 18 months**
- **Cumulative 5 year Net of \$1.15M**

- **Project Costs: \$1.68M**
- **Benefits: \$2.83M**
 - **\$2,000,000 from avoidance of hires to increase case load**
 - **\$600,000 from shifting hours of present employees to other activities due to increased efficiency**
 - **\$229,000 from elimination of reliance on outside consultants**

Taking Advantage of Predictive Modeling: Looking Beyond the Top 1% of Risk to Find Actionable Patients and Interventions

Identification is the Key

- Ideal candidate for case intervention:
 - On the brink of significant cost expenditure
 - Intervention has the potential to impact (reduce) that cost expenditure
- If the dollars are already spent, the program has less potential for savings

How Have Case Management Candidates Been Identified?

- More than 80% of case management referrals come from members who have had an inpatient stay
- 10 to 15% are identified when they reach a specific claims threshold
- The rest fall into a “miscellaneous” category
 - Self referral
 - Provider referral
 - Disease management referral

With Predictive Modeling-Focus on Top 1% Risk

- Remember the best predictive modeling tool does not have a high r-squared
- Top 1%-three probabilities
 - No intervention will prevent continued deterioration and costs
 - Intervention can significantly alter the cost outcome
 - There is a return to baseline costs independent of intervention

Timeliness is a Second Key

Earlier intervention means better outcomes. But health care organizations tend to wait until:

- A claims threshold has been reached.
- ER or inpatient utilization has become excessive.
- A chronic condition has become unmanageable.

But consider the types of claims data that are rarely flagged. These opportunities for earlier intervention are opportunities for improving and lowering the overall costs of care.

New Diagnosis of a Chronic Condition

For a new diagnosis of a **chronic condition**, case management provides an opportunity to:

- Build a trust relationship with the patient and family
- Engage the patient early in wellness behaviors and treatments that improve long-term health
- Provide early intervention to limit the condition and prevent complications.
- Avoid future hospitalizations and interventions that drive up costs

Poor Prognosis

For a diagnosis with **poor prognosis**, case management can:

- Coordinate multiple services to ensure patients get appropriate, effective care
- Involve patients in their own treatment decisions
- Keep costs under control
- Provide support for the patient and family as they grapple with end-of-life decisions.
- Remove obstacles to the best outcome — even if that means a dignified death in hospice or at home

New Onset

With new onset of services, case management offers:

- An ability to determine whether the condition is significantly worsening and to respond with appropriate care
- Alternatively, the ability to determine whether services are being administered unnecessarily

New Medication

With a prescription for a **new medication** case managers can:

- Be alerted to the new prescription via a data-mining flag
- Evaluate the prescription and the underlying condition it's intended to treat in light of the patient's overall history
- Create a plan based on a complete picture of the patient's current health status to avoid future complications

Co-morbidities and Complications

In the presence of a new onset of **co-morbidities and complications**, case management can help:

- Accurately assess severity and risk for individual members
- Intervene in cases where co-morbidities or complications indicate higher risk compared to other cases with the same primary diagnosis.
- Provide better treatment according to the needs of the “whole patient.”
- More accurately predict costs of treatment, and lower costs by coordinating care

Take Advantage of the Power

Using the identification and flagging capabilities of predictive modeling tools to go beyond traditional approaches to improve the focus of interventions on the right person at the right time is likely to enhance the return of case management activities

Discussion - Questions

