

Identification of Potential Care Management Savings Using Chronic and Acute Impact Indices

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Patent pending for Acute and Chronic Impact Indices



AGENDA

- Problem /Solution /Methodology
- Health Cost Components
- Evidence Based Guideline Gaps
- ROI Methods
- Chronic Impact Index
- Acute Impact Index

Problem

- Problem
 - Identifying members for Care Management
- Create solution for Care Management that
 - Identifies Impactable Members
 - Easy to Rank/prioritize members
 - Forecast Resources separately
 - Provides followup actions
 - Integrates Members information
 - Integrates into CM workflow
 - Results in ROI

Solution

- High-risk Identification
 - Only Step 1
 - Catastrophic Members often not impactable
- Forecasting Inpatient Stays, ER visits, Rx\$
 - Individualized action plans per member
- Forecasting Acute Care Cost
 - Identifies members with potential for high acute-cost
- Forecasting Savings
 - Identifies members with the greatest opportunity for chronic savings
 - Highest Impactability & ROI
- Implementing Forecast via Impact Index
 - Acute & Chronic Index
 - Easily Ranks Members
- Implement into Care Management tool
 - detailed Member Profiles & data mining integrated

Study Methodology - Overview

- Acute Index
 - Create Model to forecast acute-cost
- Chronic Index
 - Create Model to forecast Savings based on $\text{Yr2 Chronic Cost} - \text{Yr1 Chronic Cost}$
 - Evaluates members following guidelines vs those not
 - Applies weights to gaps & diseases in order to forecast savings opportunity
 - Forecasted Savings based on member's
 - Disease
 - Severity
 - Compliance to evidence based guidelines

HEALTH COST COMPONENTS

Health Cost Components

Total \$

Acute \$ - Nonrepeatable \$ - 20%

Chronic \$ - Repeatable \$ - 80%

Misc Preventive\$

Health Cost Components

- Acute \$
 - Inpatient Care
 - facility charges
 - professional services related to facility care
 - Emergency Room Services
 - Facility Based Outpatient Care
 - ambulance
 - ambulatory surgery
 - observation and treatment room charges
 - costly radiology and nuclear medicine
 - CT and MRIs

Health Cost Components

•Misc Preventive \$

- Non-routine preventive services
- Immunizations - long immunity periods
 - Hepatitis vaccine / Tetanus booster
- Sports insurance / Physicals / Drug testing
- Antigen testing
 - Detecting hereditary cancer
- Colonoscopy

•Chronic \$

- All \$ besides acute and above preventive

Diseases and Guidelines

Diseases

Diseases In Current Chronic Impact Index

Diabetes

CAD

CHF

Hyperlipidemia

CVA/TIA

Asthma

COPD

Depression

Potential Diseases for future Chronic Impact Index

Preventative

Osteoporosis

Schizophrenia

HIV/Aids

Rheumatoid Arthritis

Migraine

Multiple Sclerosis

Chronic Renal Failure

High Risk Pregnancy

Diabetes Guidelines

- Diabetes with eye exam
- Diabetes with HGBA1C testing
- Diabetes with microalbuminuria testing
- Diabetes with ACE inhibitor
- Diabetes with LDL testing
- Diabetes w/hypertension used appropriate Rx
- Diabetes missing multiple guidelines

CHF Guidelines

- CHF w/ hypertension & using appropriate Rx
- CHF with hypertension and received ECG
- CHF and received ACE, ARB or beta blockers
- CHF on digoxin and received a digoxin level
- Inpatient for CHF and received ECG
- CHF and received appropriate medications
- CHF with hypertension and received ACE/ARB
- CHF with diuretics and received a chemistry panel
- CHF with atrial Fib on coumadin

CVA/TIA Guidelines

- CVA with atrial fib on Coumadin
- CVA on coumadin or clot inhibitor
- CVA and received lipid lab testing
- CVA w/ hypertension & using appropriate Rx
- CVA on Coumadin and received a protime test

GAPS - Statistics

Disease	Count	%	Y1\$	Y2\$
CHF	4,498	0.5	9.45	6.54
CVA	3,625	0.4	8.00	4.89
CAD	19,334	2	5.82	4.05
COPD	13,225	2	4.79	3.76
Diabetes	41,111	5	3.38	3.15
Depression	27,544	3	2.89	2.54
Asthma	28,777	3	2.58	2.25
HyperLipidemia	126,846	14	2.45	2.29
Total Diseases	183,128	20	2.49	2.28
Gaps=0 compliant	63,933	7	2.26	2.13
Gaps>0 noncompliant	119,234	13	2.61	2.35
Total	892,577	100%	\$2,282	\$2,616

Disease Management ROI Methodologies

Calculation of Cost Savings - ROI

- Choosing Disease Management programs based on ROI
- Two Calculation Approaches
 - Direct Approach
 - Total cost for disease-specific member
 - Indirect Approach
 - Utilization measures like admits, ER visits, procedures

ROI Methods

- Pretest–posttest design
 - before & after DM implementation
 - most common method
 - no control group for outcome comparisons
 - several sources of bias
 - competing extraneous confounding factors
 - difficult to conclude difference due to program intervention
- Randomized Control Trial
 - ideal for overcoming above issues
 - not practical
 - DM already underway
 - time and effort
 - control group ethical/legal considerations

ROI Methods

- Comparison Study vs Control Group
 - reliable
 - control & study group may be reasonably similar, but not identical/randomized-selection as in randomized control
- Propensity Score
 - Study/managed group vs control/non-managed group
 - with differences on their covariates
 - leads to biased estimates of cost savings
 - Propensity Score - the conditional probability of being managed given the covariates
 - Used to balance covariates in the two groups & reduce bias
 - To create this balancing PS uses:
matching, stratification, regression adjustment or combination

ROI Methods

Predictive Model Adjustment – MEDai's approach

- Instead of comparing 2 groups
- Build predictive model that accounts for differences between them
- Control group data used to develop model that calculates expected-costs for study group
- Predictive model avoids differences between both groups.
- Predictive model blind to differences because
 - We build expected costs model using the control group and apply it on the study group

Savings for study group = Actual\$ - Expected\$

**Predictive Model
Approach –
Chronic Impact Index**

Predictive Model – Chronic Impact Index

- **Problem:**
 - 8 diseases with 42 gaps
 - decision support system that identifies compliance to guidelines using
 - Medical/ Rx claims/ lab results
 - Create model to calculate
 - member-level savings for any combination of gaps and diseases.
 - Savings based on:
 - gap disease(s)
 - gaps' count
 - severity of the member's health status
 - demographics (sex, age)

Predictive Model – Chronic Impact Index

- Dependent Variable – Chronic Savings
 - 1 ● Does not have one of the chronic diseases/conditions
Indicates NA
 - 0\$ ● No savings opportunity
 - Has disease but is following all recommended guidelines
 - >0\$ ● Has savings opportunities
 - Patients with one of the chronic diseases
 - Not following guidelines
 - Patients with catastrophic disease or outlier-cost are weighted down

Predictive Model – Chronic Impact Index

- No strict separation of members into study vs control
 - Diabetic Member
 - Compliant with guidelines 3 thru 7
 - part of the control group
 - Noncompliant with guidelines 1&2
 - part of the study group for calculation of the cost savings for guidelines 1&2
 - Members participated in different DM programs. Therefore we have to reduce the bias at the individual level, not only at group level

Predictive Model – Chronic Impact Index

- To create generalizable model across 8 diseases:
 - Requires many disease/gap combinations
 - Large N
 - 2 years claims data
 - 671,513 members at least one disease
 - 461,041 had one or more gaps – non compliant
 - 210,472 had zero gaps - compliant
 - Many cost savings studies use only a few hundred - few thousands members (max <50k)
- Working Hypothesis:
 - The 8 diseases/gaps have different influences on cost components according to forecast period
 - Short Forecast Period (1-2 yrs)
 - Gaps main influence are on chronic cost
 - Longer forecast (4+ yrs)
 - Gaps lead to more severe diseases / much higher cost - acute cost

Chronic Impact Index – The Model

Overall Study Group Savings =

- **Actual\$ - Expected\$**
- Future Actual Chronic\$
 - is not only the result of guideline compliance
 - Other factors
 - therefore can't use Chronic\$ of non-compliant members but instead must smooth this cost to avoid uncertainty/bias thru modeling
- Model should use
 - expected Cost if member 100% compliant
 - gap diseases/gaps/Chronic\$/demographics if pt noncompliant

Individual Savings =

- **Expected\$(non-compliant) - Expected\$(compliant)**

Chronic Impact Index – Data

- Data
 - 2 years claims data
 - 671,513 members at least one disease
 - Compliant Members - 210,472
 - Non compliant - 461,041
 - Randomly Split into two datasets A&B
- Training Set
 - Compliant Member Dataset
 - Noncompliant dataset A
- Validation Set
 - Noncompliant dataset B

Chronic Impact Index – Modeling Steps

- **Step1**
 - Use Compliant Member dataset to develop model to calculate Compliant-Expected-Chronic\$
 - non-linear model many clusters
interactions/transformations of the predictors
mini-models for more than 18 different body systems
- **Step2**
 - Apply Step1 model on Noncompliant members to calculate their Compliant-Expected-Chronic\$ as if they had no gaps

Chronic Impact Index – Modeling Steps

- Step3
 - Use NonCompliant Dataset A to develop model to calculate NonCompliant-Expected-Chronic\$
 - Basically adjust Compliant-Expected-Chronic\$ for the non-compliant members using predictors that describe gaps/diseases/severity
- Step4:
 - Apply Step3 model on NonCompliant DataSet B Validation Set
- Individual Savings =
Non-CompliantExpectedChronic\$ -
CompliantExpectedChronic\$

Chronic Impact Index – Modeling Steps

- Step5: Adjustment based on
 - Catastrophic disease presence
 - Severity according to year1 chronic cost
- Parameters
 - Catastrophic & chronicyr1 \geq \$25k
 - Catastrophic & chronicyr1 \$5-\$25k
 - No catastrophic but chronicyr1 \geq \$50k
 - No catastrophic but chronicyr1 \$35-50k

Chronic Impact Index – Formulate the Index

- Create Easy to use **Index**

- Convert \$ Savings to percentile ranking

- Percentile Ranges:

0

- Does not have one of the 8 diseases
Indicates N A

10

- No savings opportunity
 - Has disease but is following all recommended guidelines

70-100

- Has savings opportunities
 - Patients with one of the chronic diseases
 - Not following guidelines
 - Range typically around 70-100 but can be 66-100 or 93-100 etc. depending on your plan's percentage of noncompliant patients.

**Results –
from Chronic Impact
Model**

Results

- **Validation set**
 - **Truncation - \$50k**
 - **Forecasting Year2 Chronic \$**

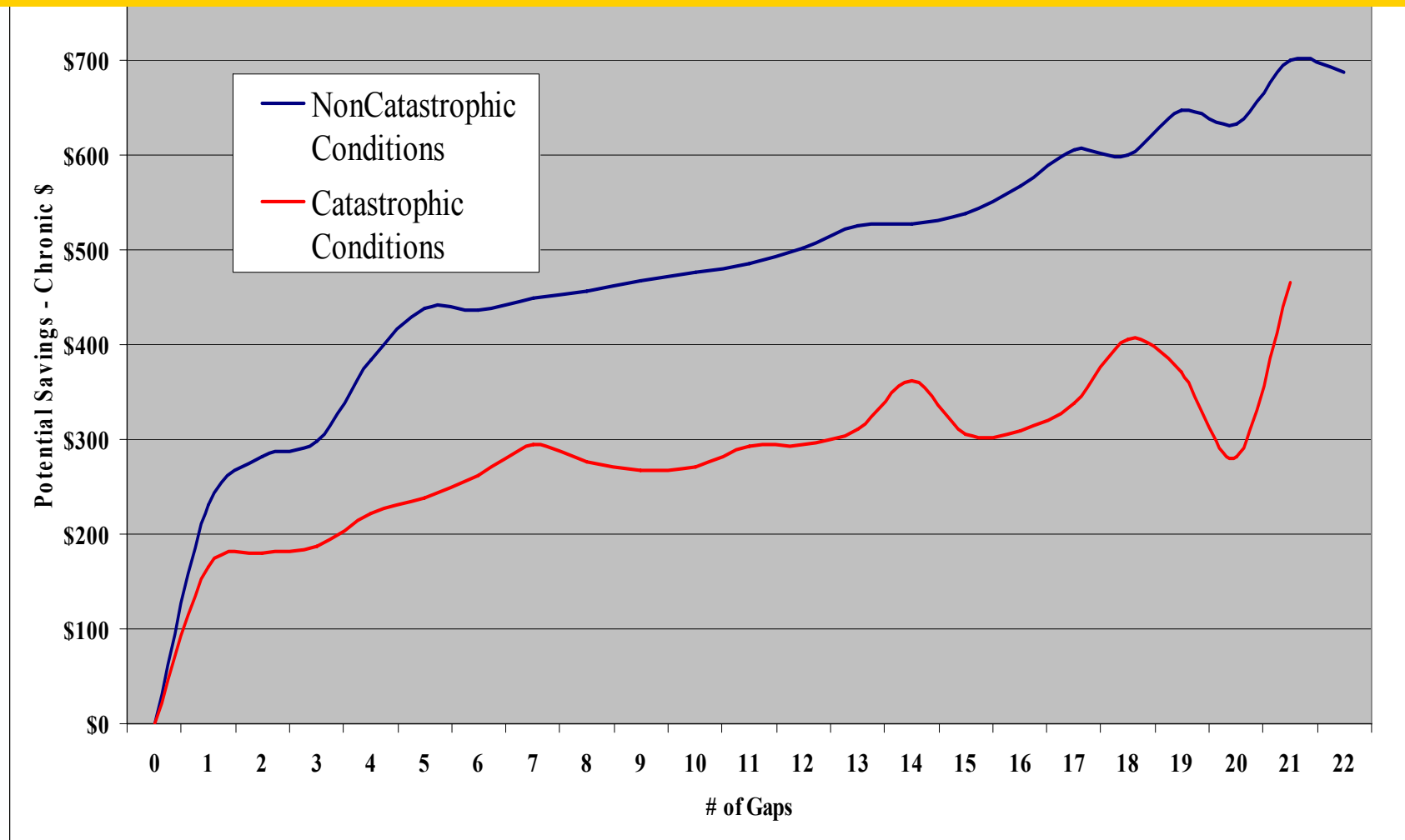
Model	Corr	R2	Sn(10%)
Chronic1\$.611	.301	50.16%
CompliantChronic\$.643	.407	53.34%
Non-CompliantChronic\$.644	.414	53.76%

Results

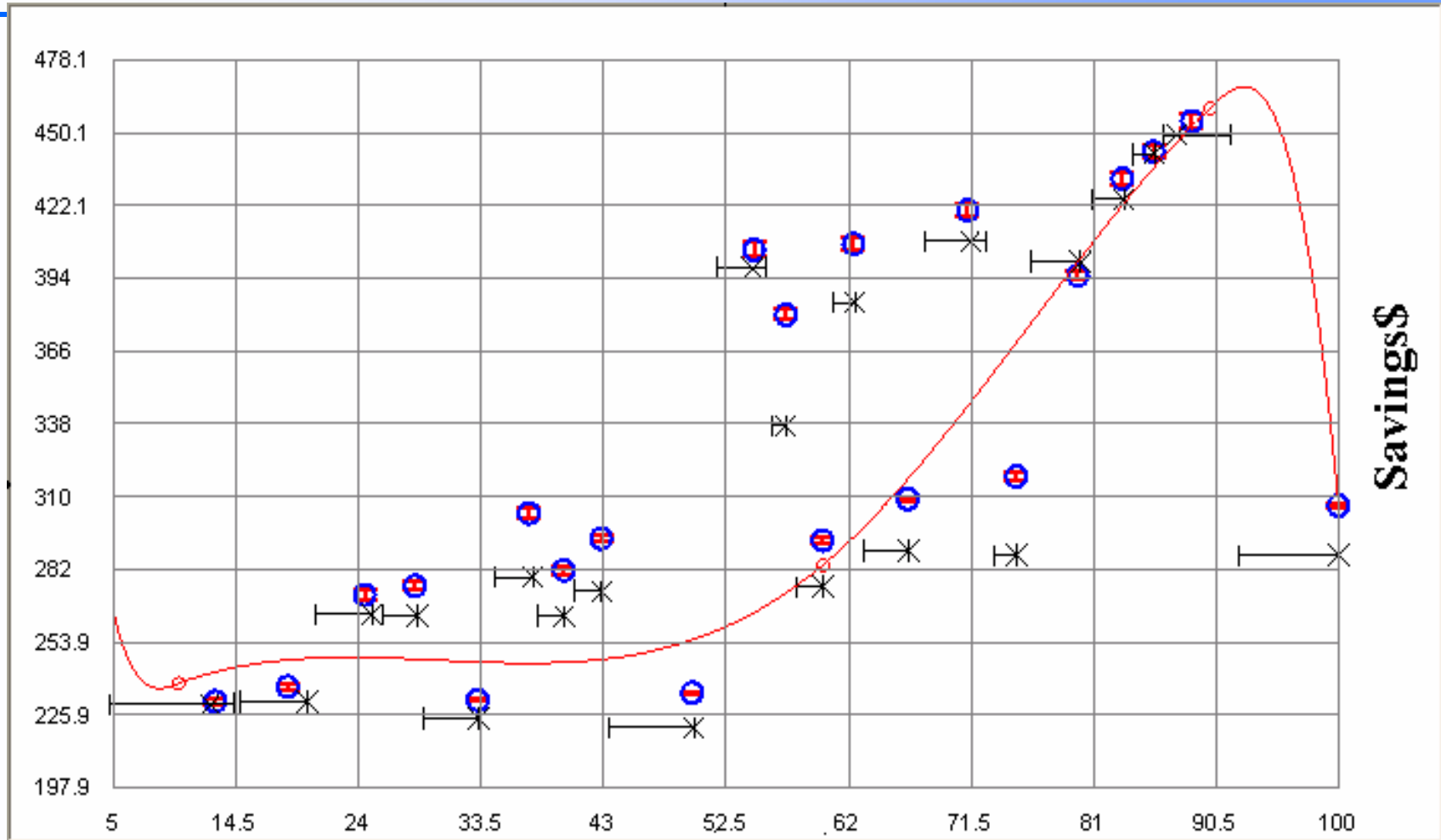
Gaps	Count	Chr1\$	Chronic Savings\$	Guide lines	Diseases	Claims#	Body System
1	114102	1851	214	1.58	1.08	15.50	5.04
2	84243	1977	270	1.45	1.19	16.17	4.99
3	63171	2076	282	1.83	1.34	17.38	4.91
4	33626	2745	374	2.57	1.61	20.70	5.50
5	26962	2664	429	1.88	1.64	19.46	5.18
6	11865	3201	426	2.69	2.12	24.79	6.06
7	7315	3352	435	2.81	2.41	27.92	6.32
8	3856	4003	438	3.26	2.67	32.89	6.85
9	2158	4399	441	3.93	3.07	39.45	7.40
10	3438	4621	464	3.53	3.35	46.48	7.72
Total	350,736	2213	289	1.83	1.36	18.02	5.18

Chronic Impact Index:

- Higher potential savings when you can close the gap on patients with numerous noncompliant guidelines.
- Weights vary among diseases & guidelines.
- Catastrophic conditions show less savings potential

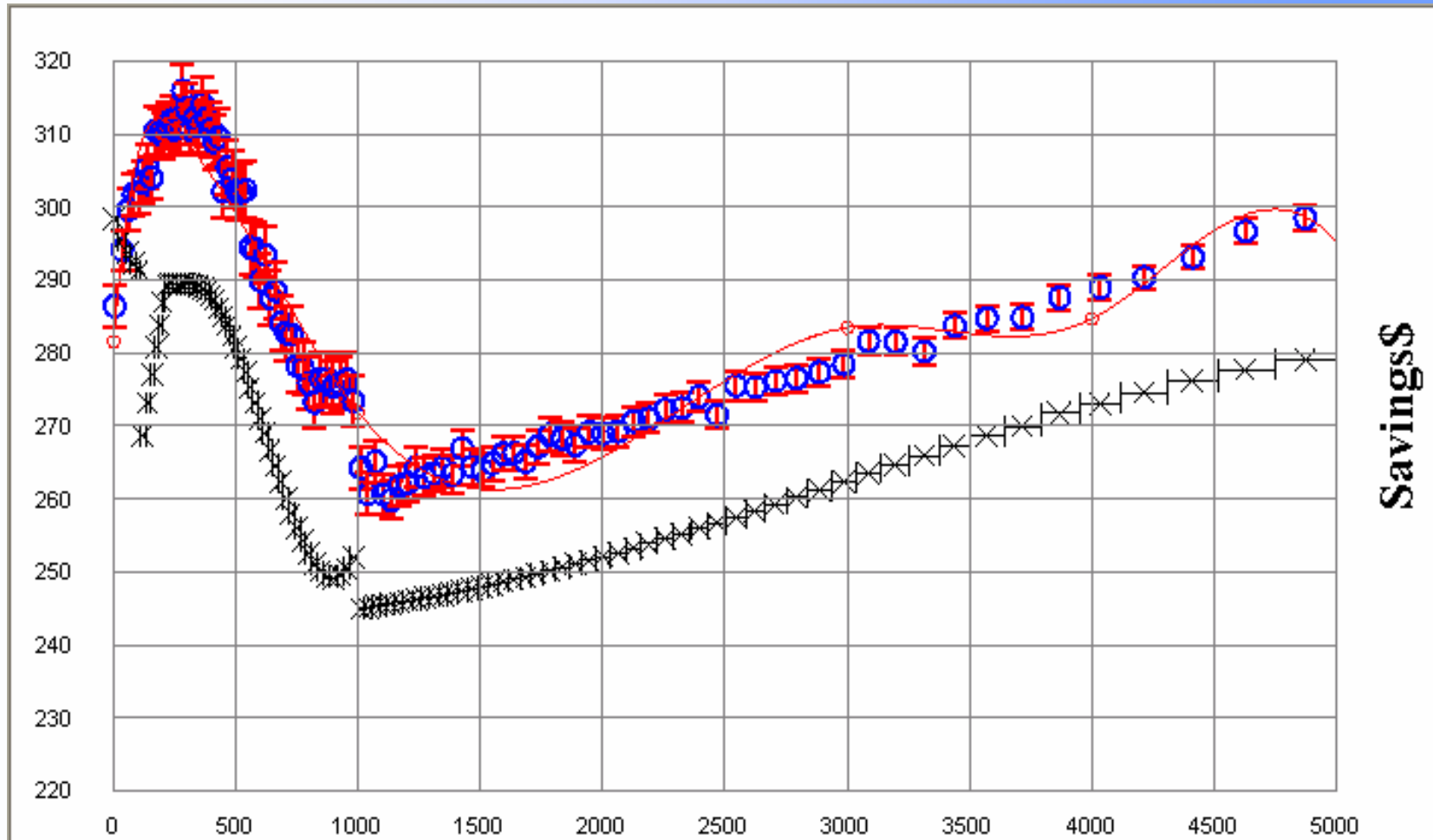


Results



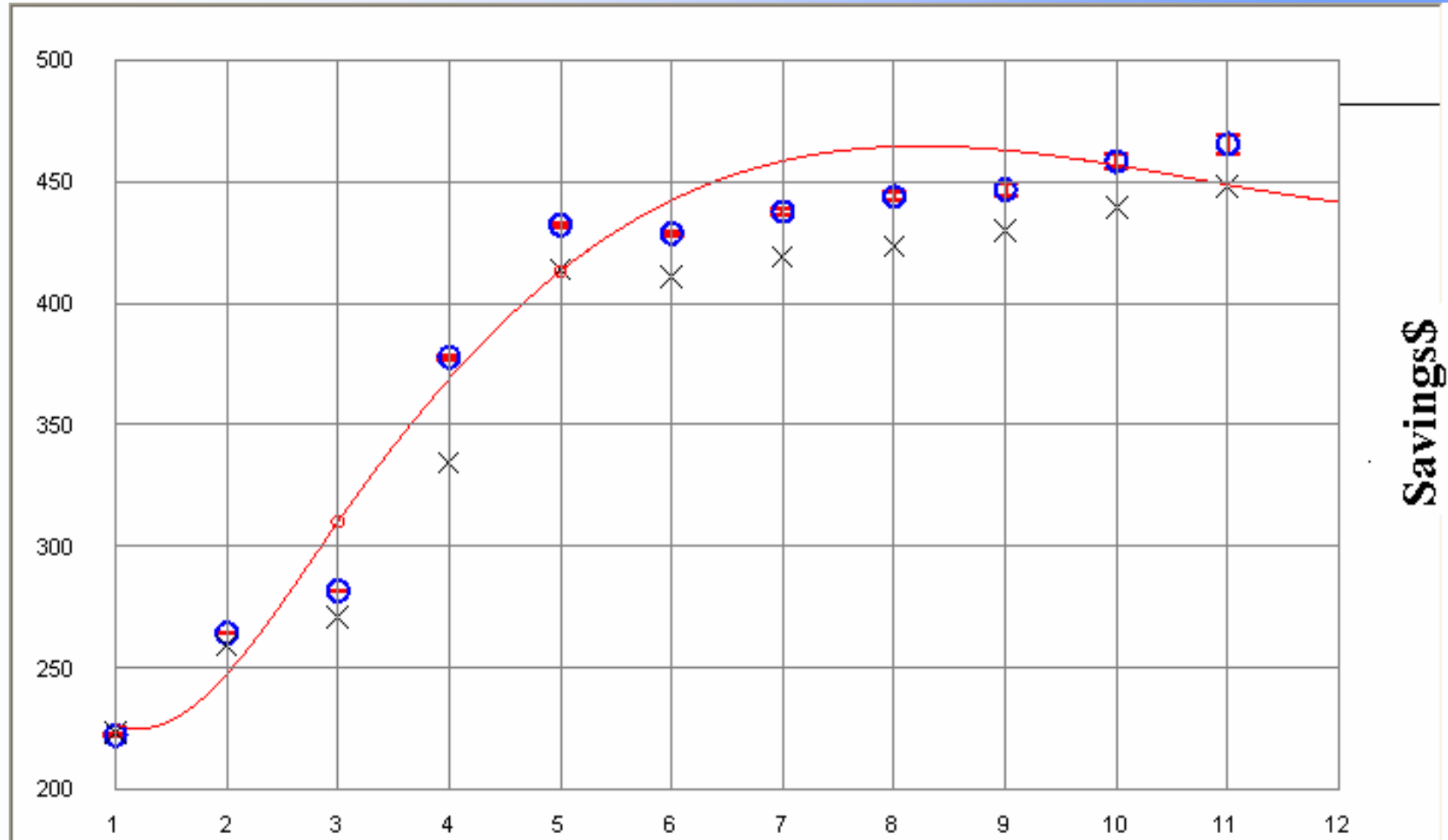
$$\%Gaps = 100 * Gaps / (Gaps + Guidelines)$$

Results



Chronic1\$<=\$5,000

Results

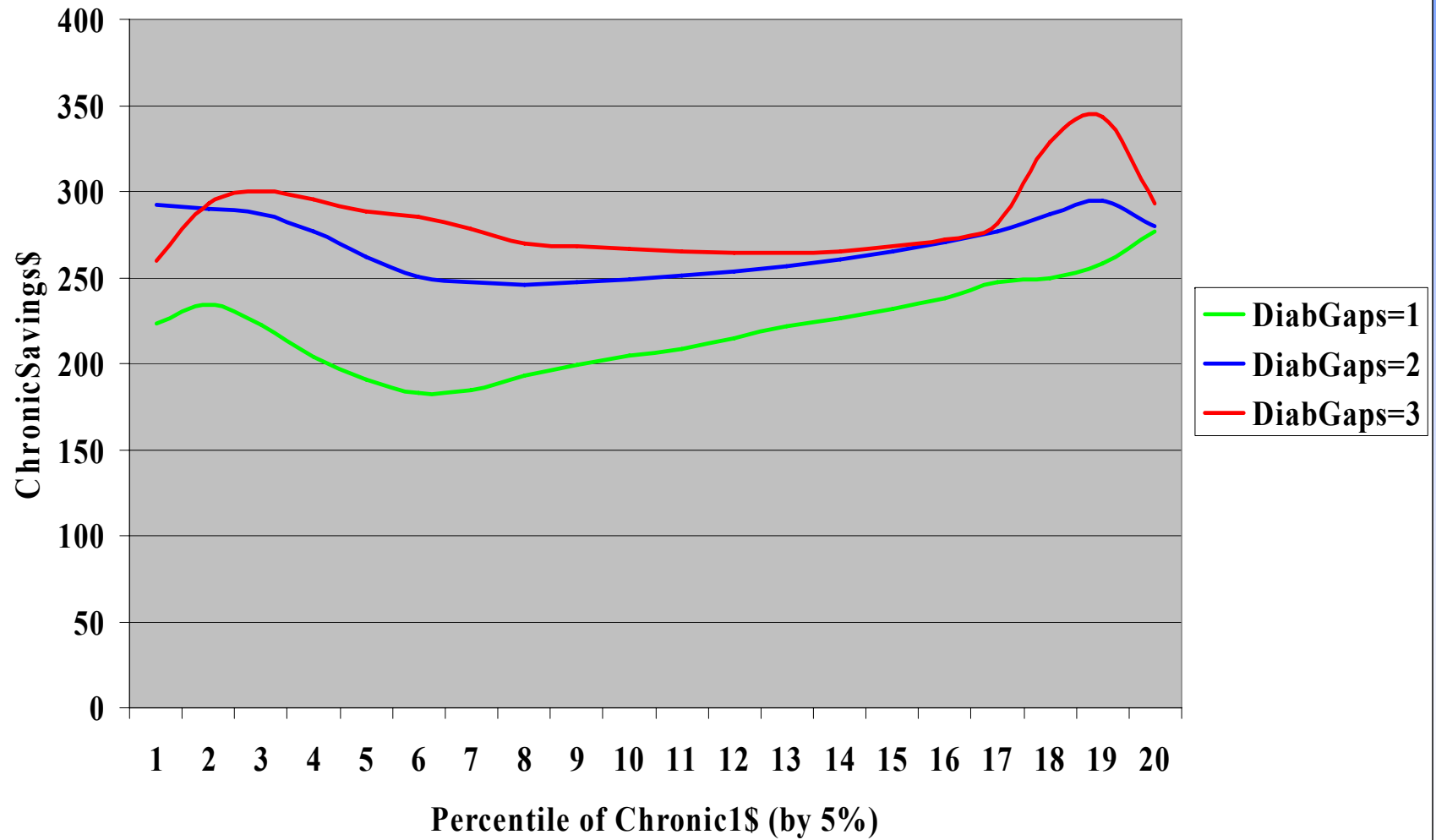


Gaps Count - 93,094 Diabetic Members with Chronic1\$ \leq \$10,000

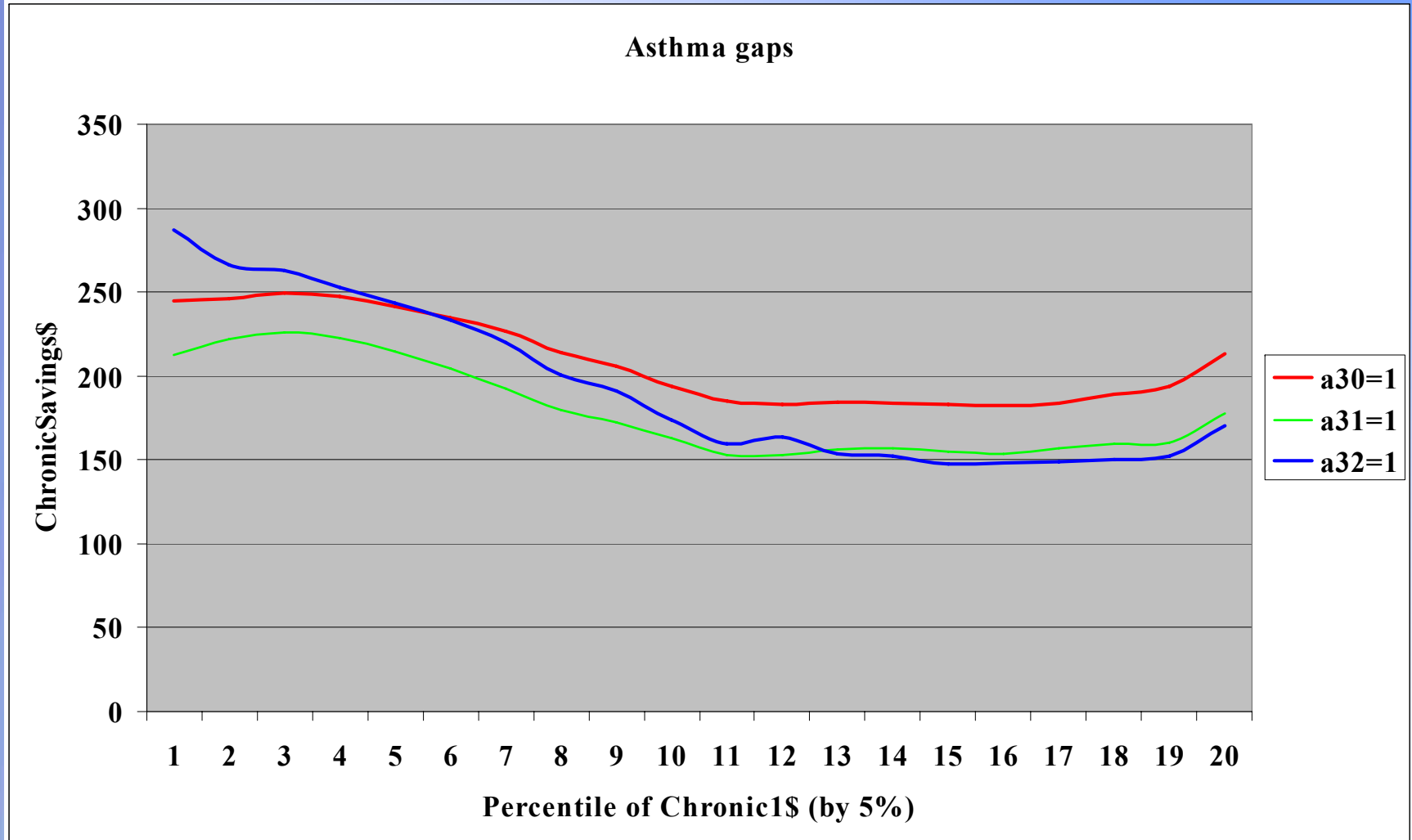
For severe diabetics, potential Savings increase with increased noncompliance

Results

Diabetes Gaps



Results



G30_AsthmaRx
G31_AsthmaStrd
G32_AsthmaTest

Asthma and received primary treatment medications
Asthma and received inhaled steroid
Asthma and received PFT's

Chronic Impact Index - Summary

- Identifies members producing highest level of future savings by adherence to guidelines
- Members Ranked using Chronic Impact Index
- Implement via Care Management application
 - Integrated Member Profiles
 - Diagnosis / RX / Lab History
 - Risk Driver Profile
 - Guideline Compliance Profile
 - Data mining capability
 - Employer Reporting
 - Physician Profiles

Acute Impact Index

Acute Impact Index

- Ranks individuals by opportunity to avoid high cost acute care
- Reflects IP and ER component of overall prediction
- Score of 97 or greater identifies patients with greatest potential for controlling cost

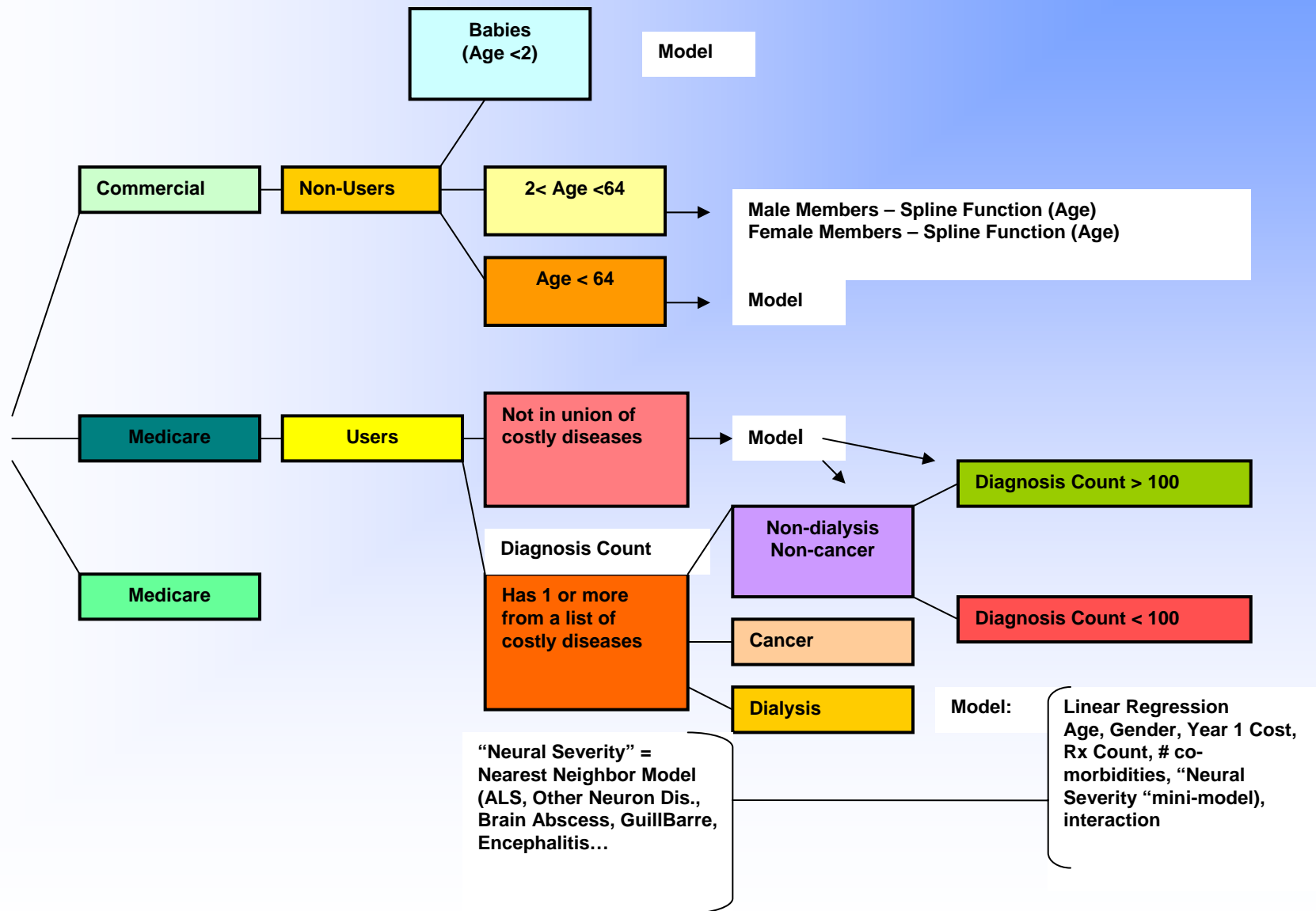
Calculation

- Each Member receives Forecasted ER Visits / Inpatient LOS
- Normalized to Dollars
- Creating a forecasted Acute Care Cost
- Cost Ranked Ascending
- Then Transformed to Percentile 1-100
- Acute Index used for care management ranking
 - 0–79.99 – Members in the 0-95% of forecasted acute events
 - 80-100 – Members in the top 5% of forecasted acute events

Models used for creating Acute Index

- Models for predicting
 - Inpatient LOS (Yr2)
 - ER Visits (Yr2)
- Models built on
 - 2 yrs medical & Rx claims
 - From repository of 14 million lives
- Independent Variables
 - Yr1 - Diagnoses/Comorbidities/Drugs/Visits...
- Non-linear models
 - interactions/transformations of the predictors
 - mini-models for more than 18 different body systems
- Statistical procedures used
 - decision trees /nonlinear regressions/nearest neighbors
 - spline estimators

Acute Models – Model Decision Tree



Acute Models - Clusters Used

	Cluster	Count	Actual	Predicted
1	Commercial Non-HMO Non-Users	279,859	423	444
2	Medicaid Non-Users	92,715	603	622
3	Baby & EC	13,351	1,981	2,001
4	Baby & No EC	16,992	1,165	1,073
5	DiagCnt=0 & Chronic\$ <\$120	27,592	822	778
6	DiagCnt=0 & Chronic\$ ≥\$120	26,387	2,003	1,906
7	Medicaid, No Drugs, EC, CM <4	26,829	1,143	1,148
8	Medicaid, No Drugs, EC, CM ≥4	21,190	3,171	3,012
9	Medicaid, No Drugs, No EC, CM <2	42,144	619	603
10	Medicaid, No Drugs, No EC, CM ≥2	50,401	1,121	1,125
11	Medicaid, Drugs, EC, CM <5	41,922	1,250	1,298
12	Medicaid, Drugs, EC, CM ≥5	69,957	3,235	3,305
13	Medicaid, Drugs, No EC, CM >3	32,185	651	668
14	Medicaid, Drugs, No EC, CM ≥3	47,935	1,206	1,221
15	Commercial, No Drugs, EC, CM <3	36,680	1,122	1,142
16	Commercial, No Drugs, EC, CM ≥3	48,501	2,849	2,851
17	Commercial, No Drugs, No EC, CM <2	65,151	769	768
18	Commercial, No Drugs, No EC, CM ≥2	45,410	1,263	1,195
19	Commercial, Drugs EC, CM <4	127,084	2,531	2,477
20	Commercial, Drugs EC, CM ≥4	147,105	5,515	5,486
21	Commercial, Drugs No EC, CM <3	148,110	1,483	1,513
22	Commercial, Drugs No EC, CM ≥3	71,026	2,590	2,594

Results

Validation set: Commercial / 893k members

- **LOS**

- Frequency = 3.83%
- Truncation = 60 days

<u>Cluster</u>	<u>Correlation</u>	<u>R2</u>	<u>Sensitivity (10%)</u>
All	.281	.075	20.6%
Year1 \geq \$500	.291	.081	21.8%
Year1 \geq \$3,000	.320	.100	25.8%

- **Emergency Room Visits**

- Frequency = 12%
- Truncation = 15 visits

<u>Cluster</u>	<u>Correlation</u>	<u>R2</u>	<u>Sensitivity (10%)</u>
All	.380	.144	28.7%
Year1 \geq \$500	.400	.160	23.9%
Year1 \geq \$3,000	.471	.221	29.9%

Results

Inpatient Admissions

Predictive Model

Accurate Prediction

Top0.5% Top1% Top2%

Acute Cost (new)	39.1%	31.7%	24.7%
Acute Impact Index	38.7%	31.4%	25.4%
LOS	38.3%	30.9%	25.1%
Total Cost	35.8%	28.3%	23.3%
<u>Emergency Room Visits</u>	<u>29.3%</u>	<u>23.9%</u>	<u>19.0%</u>

Total Members	4,463	8,925	17,852
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Green – the best result

Yellow – the second best result

Results

Emergency Room Visits

Predictive Model

Accurate Prediction

Top0.5% Top1% Top2%

Emergency Room Visits

65.1%

56.8%

47.9%

Acute Cost (new)

41.0%

37.7%

33.7%

Acute Impact Index

38.6%

36.2%

34.0%

LOS

37.0%

34.4%

32.0%

Total Cost

35.4%

33.3%

30.7%

Total members

4,463

8,925

17,852

Green – the best result

Yellow – the second best result

Results

Acute Cost

Predictive Model

Avg Actual Acute Cost

Top0.5% Top1% Top2%

Acute Cost (new)

\$18,349

\$13,596

\$9,882

Total Cost

\$16,466

\$12,236

\$9,354

Acute Impact Index

\$16,391

\$11,952

\$8,829

LOS

\$16,149

\$11,870

\$8,796

Emergency Room Visits

\$10,524

\$8,073

\$6,250

Total members

4,463

8,925

17,852

Potential savings over

\$4.2M

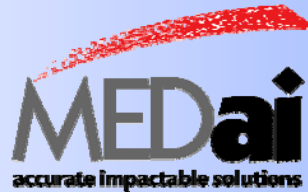
\$6.07M

\$4.7M

Green – best result / Yellow – second best

Conclusions

- Problem
 - Identifying impactable members for Care Management
- Solution
 - Indexes very useful for identifying members in order to produce highest level of future savings & ROI
 - Chronic Impact Index
 - Acute Impact Index
 - New model for Prediction of Future Acute Cost
- Implemented
 - Into Care Management application
 - Detailed Member Profiles
 - Data mining integrated



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