

The Cost of Chronic Conditions

A key focus for care management and predictive analysis

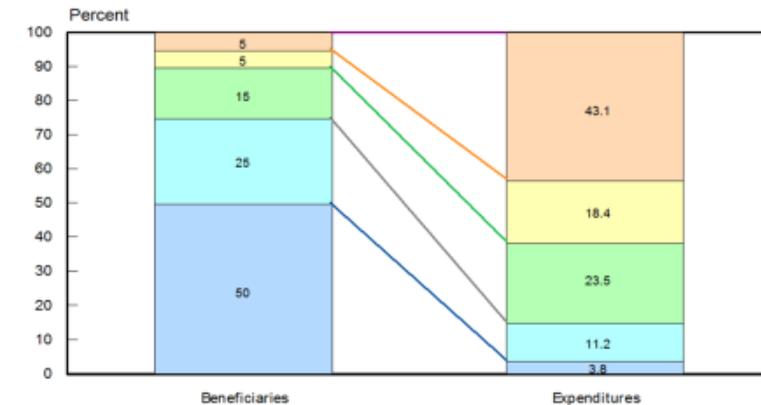
With rising costs and limited budgets, we need to identify causes and solutions: “Which members should we target for intervention?” and “How can we reduce readmissions?”

With Medicare, for example, ~60% of total costs are driven by 10% of the population and cost growth is fueled by ten chronic conditions as shown in the graphs to the right.

This familiar graph highlights the key issue: payers and providers need to identify at-risk members and cost drivers, manage risk, target interventions and improve care. All of these changes require improved ‘intelligence’ to guide the healthcare process.

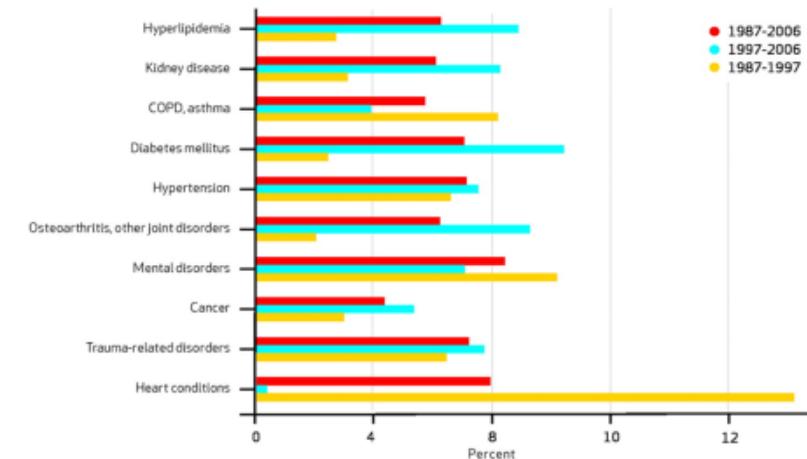
PreVista™ can target each chronic condition – and combinations of chronic conditions – to identify the most at-risk members and the treatments that are most effective.

The following PreVista example focuses on diabetes, one of the most complex challenges -- with a wide age range of members and co-morbid conditions.



Source: CBO based on data from CMS

Contribution Of Key Medical Conditions To Inflation-Adjusted Health Care Spending Growth Among Medicare Beneficiaries, 1987–1997, 1997–2006, And 1987–2006.



Thorpe K E et al. Health Aff 2010;29:718-724

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▶ Predict Year 2 costs / risk for a general diabetes group

A group of members with diabetes were selected – including a wide range of ages and co-morbid conditions. This was a chaotic data set with many wide-ranging variables that made prediction particularly difficult:

- ✓ 3,937 members
- ✓ Age range: 1 to 91
- ✓ Outpatient visits: 1 to 325
- ✓ Number of co-morbid conditions: 0 to 32
- ✓ Year 1 costs: \$3 to \$421,915
- ✓ Change, Year 1 to Year 2: -\$285,883 to +\$313,423

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► Data sources

One year of standard medical and pharma claims were used as inputs, along with a few basic fields from the client’s care and disease management system.

(Shown to the right)

Lab and EMR data was not yet available for these members. This more current and detailed data would be very helpful with PreVista.

Age
Gender
Frailty flag
Medical claims cost - prior year
Pharmacy cost - prior year
Active ingredients - count
Rx gaps - count
Major procedures - count
Inpatient hospitalizations - count
ED visits - count
Outpatient visits - count
Management visits - count
Providers - count
Specialists – count
Total co-morbid conditions – count
Hospital dominant conditions - count
Nursing services
Dialysis services
Immuno suppression treatment

Chronic obstructive pulmonary disease
Asthma
Ischemic heart disease
Congestive heart failure
Renal failure
Hypertension
Lipid metabolism disorders
Osteoporosis
Low back pain
Rheumatoid arthritis
Hypothyroidism
Age related macular degeneration
Pregnancy without delivery
Seizure disorders
Glaucoma
Depression
Bipolar disorder

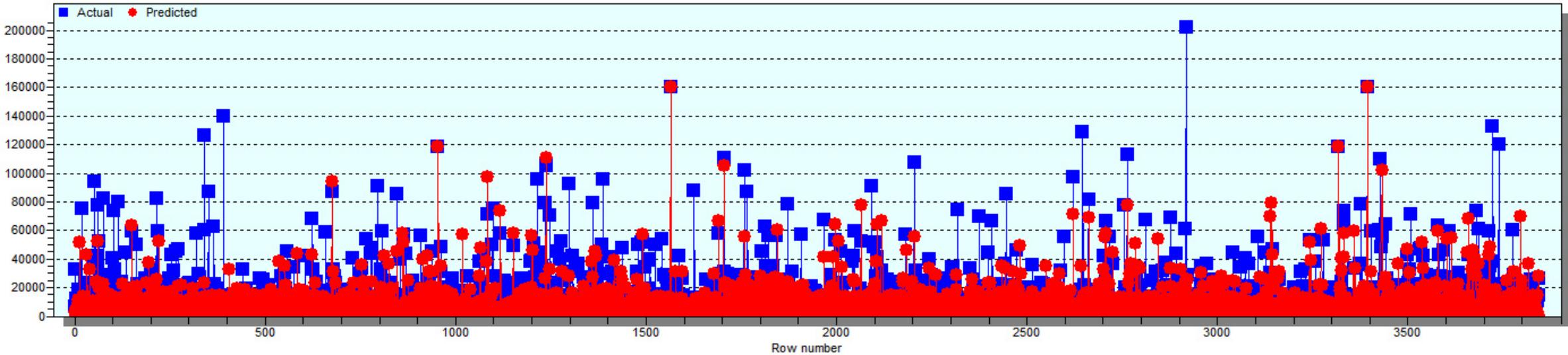
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An example of PreVista™ results with diabetes

► Initial results: PreVista neural network

An initial 'test' run with the neural network produced R2 accuracy of only .32 (32%). This would be a good result for standard 'predictive modeling' and 'risk score' products. In the graph below, blue = actual costs and red = predicted:

Best net statistics	
R-squared	0.322757
Avg.error	5423.829
Correlation	0.615839
MSE	1.03E+08
RMSE	10151.46
% in range	0.0%
% same sign	99.9%



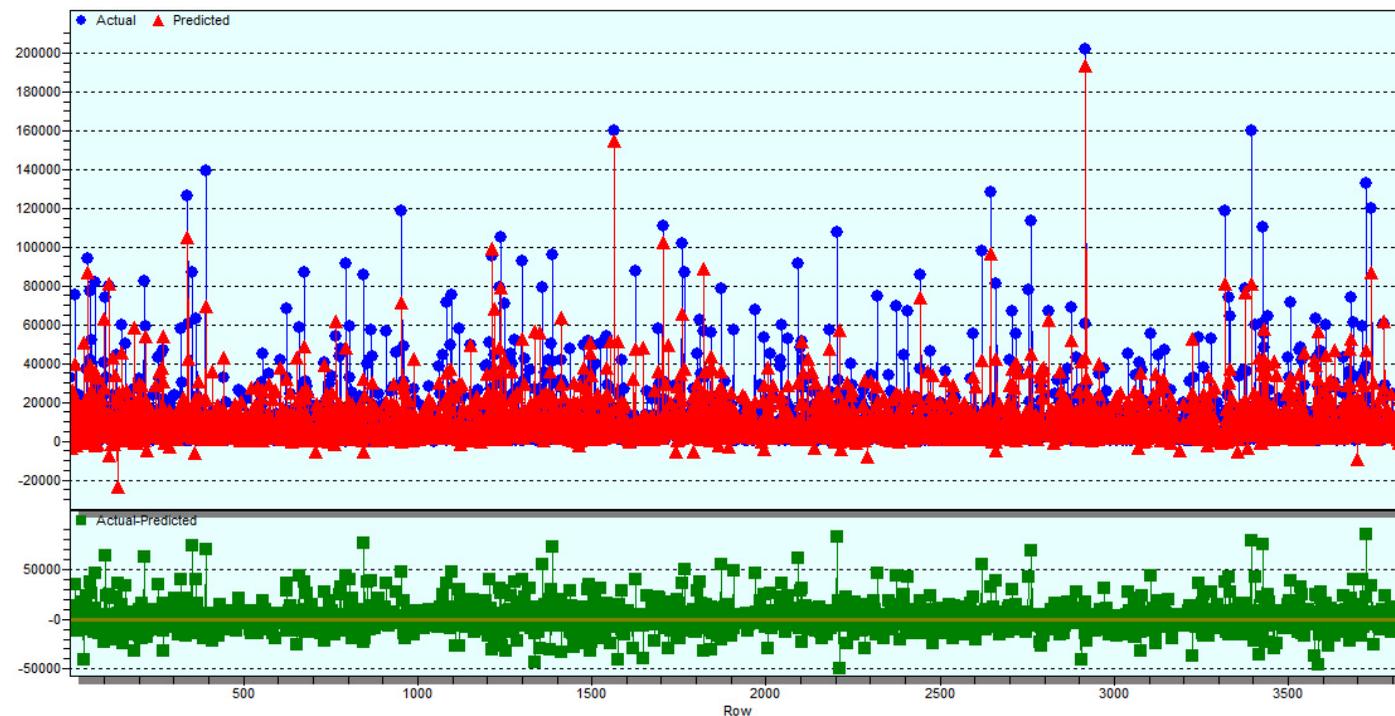
Technical note: The cost range is limited to \$200,000 due to the elimination of 90 'outlier' records which would skew the training process.

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An example of PreVista results with diabetes

► Training run 2: neural network with GA tuning

The PreVista genetic algorithm was added, to identify and weight key factors in the data. These results were loaded into the neural network. R2 accuracy jumped to .56 (56%). The green section of the graph shows the delta between predicted and actual results:



R-squared	0.555009
Avg.error	5264.054
Correlation	0.744989
MSE	9.17E+07
RMSE	9576.202
% in range	0.0%
% same sign	98.5%

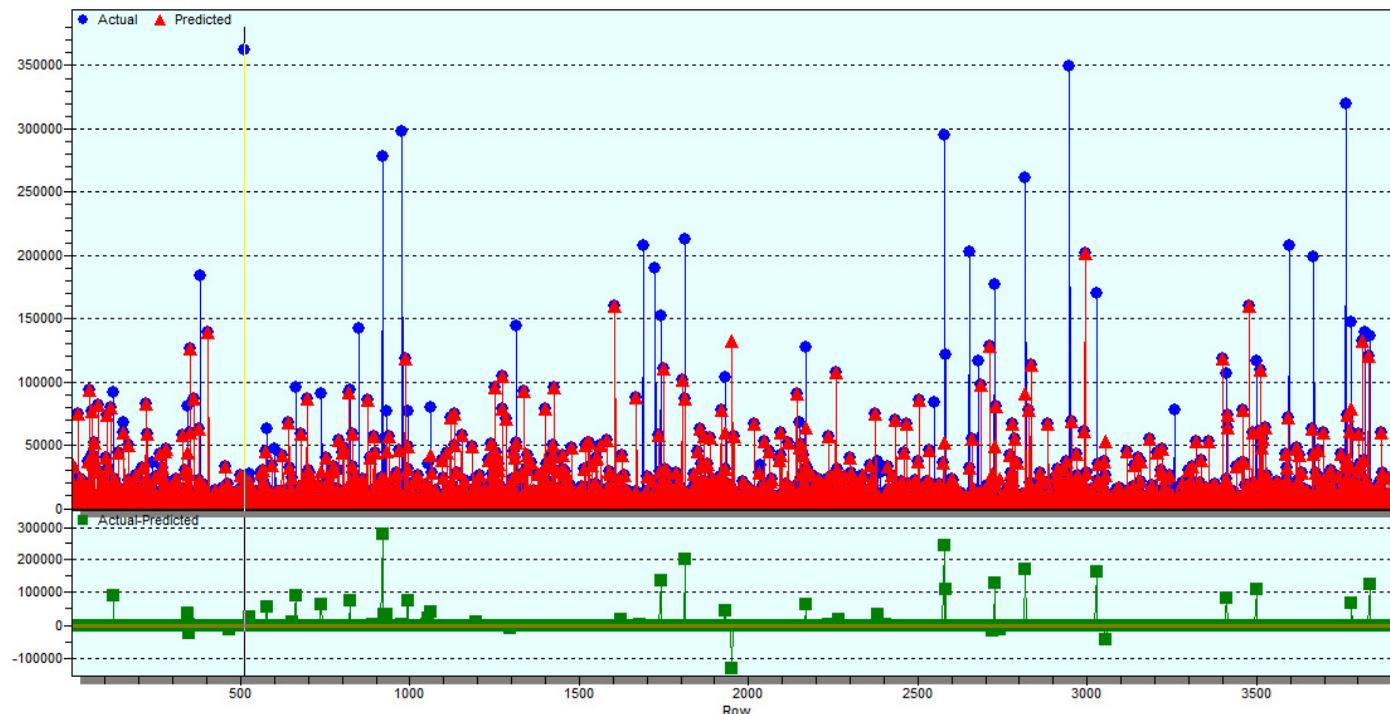
Technical note: The cost range is limited again to \$200,000 due to the elimination of 90 'outlier' records which would skew the training process.

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► Training run 3: neural network with additional GA rounds

Genetic algorithms are process intensive. Each PreVista run with the diabetes data set included 100 rounds and required 4 days of computation time on an R&D server. 300 rounds were added and fed to the neural network. R2 accuracy increased to .70 (70%).



R-squared	0.697988
Avg.error	770.6569
Correlation	0.836493
MSE	9.86E+07
RMSE	9928.711
% in range	47.6%
% same sign	99.9%

Technical notes:

- The cost range increased in this graph to \$350,000 after the outliers were included, to test the trained model against the entire data set.
- The sample population used for this analysis was diverse in age and acuity. The resulting predictive model is not 'over trained' to a narrow data set, and can be re-used without additional training.

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► Additional findings

The combination of genetic, fuzzy and neural network technology often uncovers interesting relationships in the data. In this analysis of diabetes, for example, we found:

- ✓ Although 90 outliers were excluded while the PreVista model was trained, analysis was particularly accurate with this set of records – near 100%. Review of the data showed that the cases were linked to specific co-morbid conditions, e.g. renal failure. This is an example where a specific model would be trained for members who match the high-risk subset within the diabetic population. These members would be a high priority for intensive care / disease management.
- ✓ Members with Year 1 costs of ~\$40K typically showed a reduction in Year 2 of 50%.
- ✓ Members with costs between \$1K and \$3K often saw a sharp increase in Year 2 of ~10X. These members are prime targets for improved care / disease management.

Improved accuracy with PreVista

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