

Humana Inc., is one of the nation's largest publicly traded health benefits companies, with approximately 7 million members. Humana believes its competitive position can be strengthened through innovation, striving to give its customers access to flexible, personalized health benefits through the right blend of product design and information technology.

## case study in **Predicting Health Plan Enrollment** **Humana, Inc**

### The Problem

#### Accurate Predictions under Complex Conditions

There are strong drivers in the US market to decrease healthcare costs for employers while increasing health plan choices offered to employees. In response to these drivers, Humana developed SmartSuite® — an innovative set of benefit plans that offers broad choice to employees while aiming to deliver substantial savings to employers. The savings are achieved in two ways: first, the SmartSuite plans themselves are designed to control costs; second, behavior modification is a result of the extensive education process. SmartStart™ is a tool accompanying SmartSuite that allows employers to estimate costs at various contribution levels before implementation.

For employers, the cost of health coverage is mainly determined by employee enrollment choices and by employer contribution levels. Premium pricing and employer contribution levels, in turn, influence individual enrollment decisions. The circular nature of this problem can be problematic, as even a slight error in predicting enrollment can lead to substantial losses. This problem is exacerbated by the increased flexibility afforded by Humana's products. The added complexity also impacted Humana's actuaries and underwriters by increasing the number of cases to be considered, and it impacted the sales staff, who were required to respond to a broader range of client requests for plan adjustments or custom configurations.

### Our solution

#### Consumer Choice Modeling

Icosystem, a leader in modeling consumer behavior, created a predictive engine to power SmartStart. Our predictive engine is based on the assumption that consumers evaluate several aspects of each plan, compare the subjective value of that plan with their needs, and select the plan with the best match. In addition, our predictive engine recognizes the existence of other, less 'rational' factors in plan selection. For instance, we presumed that consumers have a tendency to stay with their current plan unless circumstances change.

We calibrated the engine using historical enrollment data. The calibration process was used to determine the relative contribution of each term in our behavioral model across the entire population.

“This is a major advance in our ability to develop targeted, customized benefit solutions for employers.”

J. T. Lord, Humana Chief  
Innovation Officer



# Humana: a case study in Predicting Health Plan Enrollment

## The little engine that could

“One of the beauties of this engine is how little fuel it needs to make its predictions.”

Carol McCall,  
Vice President and Director  
of Humana's Center for  
Health Metrics.

What are the advantages of considering consumer behavior in predictive modeling? By modeling the drivers of consumer choice, our predictive engine can be tuned with historical data, but it can then be used to predict behavior even for entirely novel plan combinations or contribution strategies. Also, the calibration process reveals how individuals react to various elements of the offering, such as cost and perceived benefits.

We found that the predictive engine is able to make accurate predictions on the basis of limited demographic and prior enrollment information. “One of the beauties of this engine is how little fuel it needs to make its predictions,” said Carol McCall, Vice President and Director of Humana's Center for Health Metrics. “With just a little bit of information on employees we can make remarkably good predictions about what kinds of benefits they will choose.”

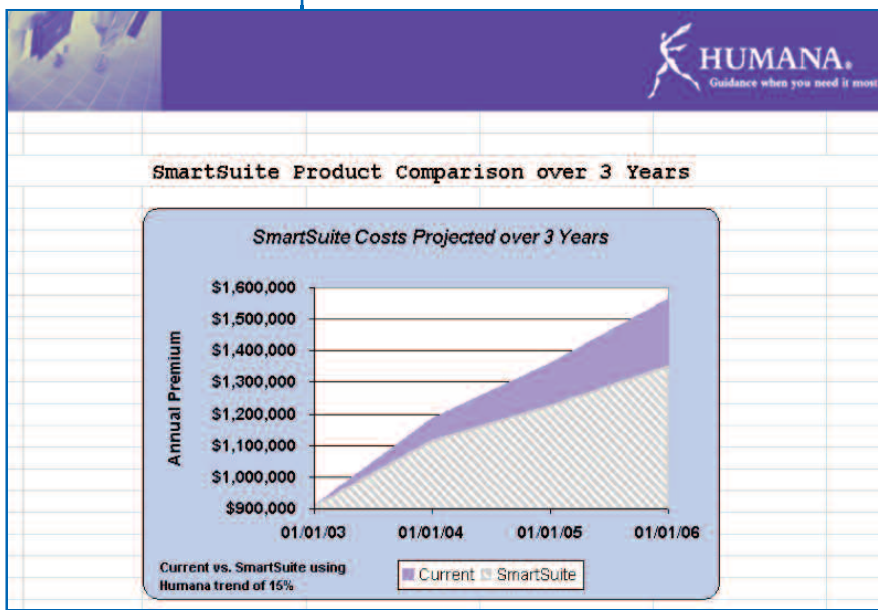
Because the predictive engine is so nimble, it requires very little processing power to run, generating predictions in a matter of seconds as the user tests different contribution strategies. During the project it became clear that the engine could be useful to the sales staff in providing quotes to Humana's clients in real time during a sales call. We helped Humana integrate the predictive engine into their sales tool to generate additional benefits from this work.

The sales tool, rolled out in early 2004, was an instant success with the sales force. Thanks to the tool's real-time calculations, Humana's sales staff were able to respond instantly to client requests and could help the clients understand how a given contribution level would impact their bottom line.

At the same time, Humana's actuaries were able to use the calibration process not only to increase prediction accuracy, but also to understand what made certain clients more difficult to predict than others.

“The power of the tool derives from the robustness in accommodating many different scenarios and requiring logic maintenance at less frequent intervals using a transparent and interactive automated recalibration tool.”

Penny Hahn, Actuarial Director at Humana.



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**The initial goal of the project was to increase enrollment prediction accuracy. However, the tool was found to offer many additional benefits:**

“This is like moving from the Farmer’s Almanac to Doppler Radar.”

Jonathan T. Lord,  
Chief Innovation Officer:

- 1 Increased confidence in pricing.**  
The increased prediction accuracy has enabled Humana to make a revolutionary offer to its clients: guaranteed first-year rates and second-year trends. This leads to a dramatic increase in client confidence and a higher likelihood of winning the business.
- 2 Reduced sales cycle.**  
In the past it was common for sales staff to visit a client site, only to come back asking the actuaries for a new quote based on a change requested by the client, which required a new set of calculations. With the predictive tool installed on laptops, Humana’s sales staff can instantly determine the impact of changes requested by the client — without requiring additional help from the underwriters.
- 3 Easy response to client customization.**  
The engine allows a client to explore variations of a given contribution strategy within a combination plan offerings. The effect of different contribution strategies on enrollment is calculated within seconds.
- 4 Higher value leverage of actuarial resources.**  
Because the engine automates the predictive calculations, and is distributed to the sales force, actuaries are freed from performing arduous predictive calculations. Actuaries are still essential to determine calibration settings, but the calibration process is shortened by using an automated data fitting algorithm to update parameters for the predictive engine. Calibrating for new groups or new data sets can be done in a few hours. The actuaries leverage their knowledge by selecting which groups should be calibrated together, or being able to isolate and analyze outliers. The tool gives actuaries significantly more power to understand clients.

- 5 Increased control and flexibility.**  
With SmartStart, Humana’s sales staff is empowered to predict costs, but calibration of the predictive engine remains the preserve of Humana’s actuaries. The tool prevents sales staff from testing plan combinations or contribution strategies that are outside of the calibration scope. This means that the actuaries retain their control and minimize the chance of inaccurate quotes.
- 6 Reduced data requirements.**  
The tool makes accurate predictions using basic demographic and enrollment data. This is appealing to employers because they do not need to make a significant data collection effort.  
  
Furthermore, this reduces the risk of exposing sensitive employee data and minimizes the risk of HIPAA liabilities.

**What began as a project to increase enrollment prediction accuracy became part of a much larger shift in how Humana offers products to its clients.**

In the words of Jonathan T. Lord, Humana’s Chief Innovation Officer:

“We’re importing new techniques from disciplines outside the health insurance world to create a whole new approach to actuarial science. We’ve developed a recalibration engine that learns from itself to improve predictability over time.”

To find out more information about this work or some of our other applications in predictive modeling for healthcare and other industries, please contact:

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