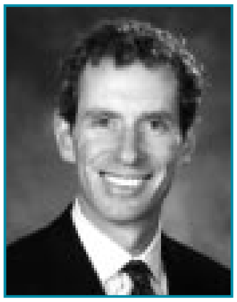

Using Third Generation Modeling in Disease Management

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During the Internet stock boom of the late 1990s, it seemed as if anyone with a stock table and a dart could pick companies that doubled and tripled in value. Unfortunately for most of us, the challenge of picking stocks returned to normal, and the task of predicting which stocks would rise in value proved considerably more difficult.

For years, investment bankers on Wall Street constructed models to predict a stock's behavior. As computers became both faster and cheaper, these models became more complex as well as more widely used. Each model, although unique, is very much a variation on a theme. The models employ specific variables in numerous combinations in an attempt to predict the future movement of a stock's price. The variables include company data, economic data, trading data, as well as other information sources. Although very intelligent professionals have been working on this task for decades, only a select few have put together models that consistently and accurately predict a stock's movement irrespective of the economic climate.

The real challenge of disease management is to identify those patients who could most benefit from interventions.

Modeling offers a tremendous opportunity to health care. With health care expenditures exceeding 15% of gross domestic product (GDP), and the aging baby-boom generation entering those "high utilization years," strategies to target interventions towards those who could most benefit become a strong necessity for a health plan's economic survival.

For more than 20 years, payors utilized disease management programs to identify and treat members with chronic diseases, who have a high risk of heavily utilizing services. These interventions were applied to reduce the utilization of expensive services.

For example, asthmatics who are poorly controlled have a much higher probability of being admitted to the hospital for a severe attack than those who are taught how to monitor their condition and properly use their arsenal of medications. Although numerous disease management guidelines exist to adequately treat patients, the real challenge of disease management is to identify those patients who could most benefit from interventions. As resources are in short supply, effectively appropriating those resources delivers the best clinical and economic value to both the member and the payor.

To enroll members in disease management programs, payors need first to identify those patients with the targeted disease and, second, stratify those members into levels of disease severity. Resources are allocated based on factors identifying those patients with the most severe disease who could most benefit from interventions. Not all patients with severe chronic disease benefit from interventions, so models need to consider clinical limitations on outcomes.

The first generation of models used basic patient demographic and clinical data (e.g., age, sex, diagnosis). A simple form of risk adjustment, these models were limited both by the simplicity of their design as well as the limitation of variables that could be obtained and utilized. Although today we take for granted our access to fast personal computers, broadband Internet, and wireless connections, for much of the last 20 years, problems in data access, format, and timeliness presented significant obstacles to identifying and stratifying

members. These first models provided the bulk of their benefit by helping to identify the patients proactively, rather than relying on self-selection, even if the model could not very well stratify patients on severity or predict outcomes.

The second generation of models utilized a much broader set of member data including both demographic and clinical data that helped paint a more accurate picture of a member's condition. In addition, a number of researchers took advantage of increasing data access and developed risk adjustment techniques that could be applied to this and other health care issues. These risk adjustment methodologies were able to classify or group patients into disease categories, allowing for easier analysis and management of these patients. Diagnosis Related Groups (DRGs) are an example of such a grouper. Although groupers offered a measurable advantage over the first generation of modeling, they still suffer from problematic levels of specificity and sensitivity that lead to unnecessary, ineffective, or missed interventions for patients.

Developed in very recent years, the third generation of models builds upon the previous two iterations while expanding their sophistication. The advantage of this new generation of modeling is based on three key characteristics:

- It incorporates any type of variable in its analysis.
- It includes multiple models and is able to utilize them as if they were variables.
- It actually learns from the data as it is analyzed and adjusts the overall model accordingly.

Some researchers call this type of software model behavior "artificial intelligence."

Utilizing these third generation predictive models provides great benefit to organizations trying to manage their members who have chronic diseases. Not only are they able more accurately to identify members, but the models adapt to the information sources available to each payor. In addition, they are able to identify and express the uniqueness of the population under study and adjust the model accordingly. In fact, these models identify the best models to apply, and in what combinations, to best predict which members require closer monitoring. All of this leads to higher levels of sensitivity and specificity in the predictive model.

Efficient use of limited resources requires not only providing necessary care, but also identifying those members who could most benefit from the care provided. Use of sophisticated software models to target interventions offers health care a valuable tool to make the delivery of care more efficient and effective.

References

Axelrod, R. C., & Vogel D. (2003). Predictive modeling in health plans. *Disease Management Health Outcomes 11*(12), 779-787.

Iezzoni, L.I. (1994). *Risk adjustment for measuring health care outcomes.* Chicago: Health Administration Press.

Barry Chaiken, MD, MPH, has more than 17 years of experience in medical research, epidemiology, continuous quality improvement, utilization management, risk management, healthcare consulting, and public health. As founder of his own company, he has worked on quality improvement studies and clinical investigations for the National Institutes of Health, the Framingham Heart Study, and Boston University Medical School. Over the past 11 years, Dr. Chaiken has provided expertise in quality and patient safety to provider organizations helping them utilize information technology to improve clinical and administrative activities. Dr. Chaiken is board certified in General Preventive Medicine and Public Health as well as Quality Assurance and Utilization Review. He is a Diplomate, on the Board of Directors, and chief medical officer of the American Board of Quality Assurance and Utilization Review Physicians (ABQAURP)