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Predictive Modeling:
Considerations for Care Management Applications

by Keith Passwater and Brent Seiler

In recent years considerable interest has developed within the actuarial ranks in applying formal, predictive modeling techniques to a variety of health insurer activities. The Society of Actuaries and its members have produced a number of valuable predictive-modeling seminars, articles and reports. Most notable among these contributions are the Health Section report, "A Comparative Analysis of Claims-based Risk Assessment Methods and Risk Assessment for Commercial Populations" (Cumming, et. al) and the Health Section seminar "Risk Assessment of Non-Medicare Populations."

Health actuaries have been pursuing the value of predictive modeling, but application of these techniques, like a lot of new ideas, has not been simple. We will discuss considerations that may be of interest to health actuaries and other professionals applying predictive modeling to health care management.

Health-Care Management Perspective

It is necessary to understand the different perspectives in predictive modeling before considering care management applications. More actuarial attention in predictive modeling has been devoted to pricing uses rather than health care management applications. Predictive modeling in pricing must recognize the differences in cost between different people and groups to price those appropriately. In care management, the primary concern is the use of resources or the intensity of different conditions

within a population—cost is not as important an aspect when comparing people with similar risk characteristics. The second consideration is that pricing must take into account the whole population. In predictive modeling for care management, the target population is a smaller segment of the whole population for which clinical intervention can improve health. The overall objective for care management is improving health, while the goal of pricing is to price the business correctly. Understanding the care management perspective is important in applying a predictive model.

Care Management Climate

Most health care managers' (health insurers, medical management outsource firms, etc.) care management objectives are to improve the health of covered members and to optimize health care cost. A variety of traditional techniques, such as pre-certification, referral authorization and utilization management, have been used over the years to achieve those objectives with mixed results. Along the way, effort has been applied to develop more comprehensive disease management and advanced care approaches. These progressive efforts have been reinforced by consumer demand for more choice and less bureaucracy. Today, most health care managers (HCMs) have begun to apply progressive care management that includes a stronger patient counseling and advocacy component. However, few HCMs have completed the transition. The graphic below depicts the characteristics of the traditional and progressive approaches to care management.
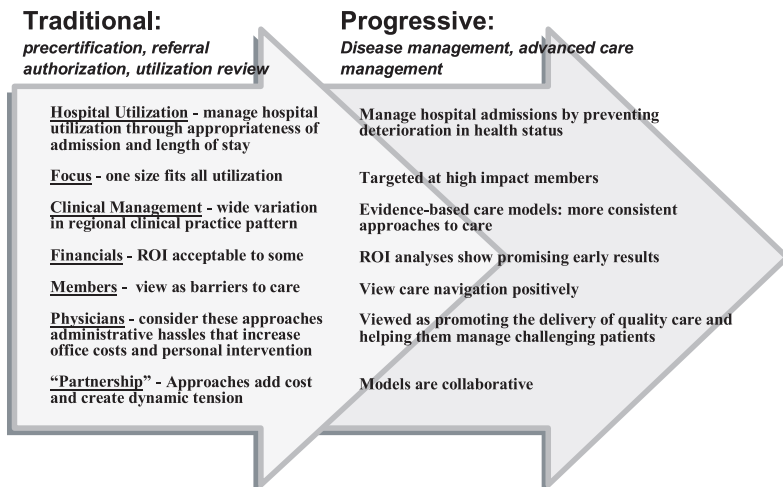
For reasons that will be discussed in the next section, an HCM who has not made significant progress in transitioning to progressive care management will likely find it better to wait before attempting to implement predictive modeling in care management.

Critical Components

Progressive care management assumes that creating interaction between patients and HCM clinicians (intervention) will be effective. Some of the critical components to making that a reality are:

1) Programs must be available to guide HCMs' interventions into patients' health issues. Considerable work has been done to develop care management programs around particular disease and condition areas, such as diabetes and hypertension. These programs are showing signs of being effective at improving quality and cost efficiency.
2) Patients' care issues must have significant associated cost and quality opportunities to justify the resource requirements of an effective intervention program. Quality and cost opportunities are difficult to define. However, significant progress is being made on the cost opportunity side through the use of predictive modeling.
3) Furthermore, such patients must be somehow culled from the entirety of the population so that they can become part of the program.
4) Data on the patients fitting the criteria and the associated programs must be deployed in some way to intervening clinicians. This data must be timely and actionable. Additionally, patient privacy must be protected.
5) Once the data and the predictive model form a basis for targeted intervention, the HCM clinicians must have the tools, the training and the materials to effectively intervene with patients.

Ultimately, it becomes obvious that an automated approach to identifying these patients and delivering the data to the clinicians will be necessary to make the program a success. How they use that information is equally important.

In this chain, predictive modeling presents a potentially better way to identify patients for care management programs and earlier intervention.

Traditional:
precertification, referral authorization, utilization review

Progressive:
Disease management, advanced care management

Traditional	Progressive
Hospital Utilization - manage hospital utilization through appropriateness of admission and length of stay	Manage hospital admissions by preventing deterioration in health status
Focus - one size fits all utilization	Targeted at high impact members
Clinical Management - wide variation in regional clinical practice pattern	Evidence-based care models: more consistent approaches to care
Financials - ROI acceptable to some	ROI analyses show promising early results
Members - view as barriers to care	View care navigation positively
Physicians - consider these approaches administrative hassles that increase office costs and personal intervention	Viewed as promoting the delivery of quality care and helping them manage challenging patients
"Partnership" - Approaches add cost and create dynamic tension	Models are collaborative

Graphic courtesy Sam Nussbaum, M.D., Chief Medical Officer of Anthem Blue Cross Blue Shield

Convincing Claims

As mentioned above, predictive modeling techniques provide a critical tool in identifying cost opportunities. Historically, cost opportunities were identified most commonly by reviewing high-claimcost patients from prior periods. In many cases, however, these patients no longer presented opportunities once they had progressed to the high claim level. The developing health issue had, by that point, already matured to a catastrophic situation. Furthermore, very expensive care had already been delivered and could not be retrospectively influenced.

Predictive modeling, in contrast, promises the benefit of identifying patients that will be high-cost patients. It would be ideal to know in advance which patients will develop catastrophic health conditions, and to know at a point that the catastrophe can be averted or at least mitigated. In fact, predictive modeling vendors offer compelling evidence that their models perform better at identifying future high-cost patients than claim-cost techniques.

1) One vendor is known to quote R^2s in the 80-90 percent range.

2) At least two vendors included in the recent SOA report (Cumming) cite the report as evidence that their predictor is the best.

3) Some vendors combine the prediction methodology with an outsourced care-management function and are willing to guarantee reduced claim cost at equal or greater quality.

As you might expect, each of these is at least partly true. However, we offer the following caveats when interpreting claims such as these.

1) We have found that reports of R^2s above 40 percent are usually reported on very narrow, very predictable disease states, such as only patients previously diagnosed with chronic renal failure. The conditions in these patients are unlikely to change significantly from year-to-year and are, therefore, much easier to predict using virtually any method.

2) The Cumming report is quite thorough and includes many analyses. The key to interpreting vendor claims as they relate to the report is to understand the various analyses and determine which relates best to the intended application for predictive modeling. It's also worth noting that there wasn't substantial differentiation among the better vendors on some of the analysis. In other words, the second-best result may be so close to the best that it's not a meaningful difference when considering differentiators between two vendors (e.g. customer service levels).

3) Progression to the mean occurs in the claims pattern for sets of high-cost patients—the cost for these patients in subsequent years tends to decline from very high levels during acute phases. This phenomenon is the result of a combination of forces. For instance, treatment in many cases does improve the individual's health.

Given that this occurs, it is important to assess to what degree predictive modeling and associated care management influences the cost and quality outcome versus what would have been observed in the absence of predictive modeling. In other words, a control group or some other mechanism is necessary to determine the contribution of outsourced care management solutions.

Therefore, the selection and implementation of predictive modeling for care management requires thorough analysis and a comprehensive review of the operational requirements.

Key Questions

This article has touched on several considerations an HCM should make when pursuing the use of predictive modeling in care management. Those considerations can be assembled in the form of questions as follows:

1) Has the HCM made significant progress in transitioning to progressive care management?

2) Are care management programs available and in place that will allow the HCM to manage patients identified for intervention?

3) Is there a system in place to deploy lists of identified patients to the care management staff, along with patient clinical data and required collateral information?

4) Which prediction mechanism most appropriately fits the HCM's objectives?

5) How will the HCM measure the effectiveness of the results? What would the costs have been in the absence of the program?

The answers to the questions above will determine whether the HCM is ready to pursue an implementation of predictive modeling in care management, and, if ready, what steps must be taken to achieve a successful implementation. ♨

Keith Passwater, FSA, MAAA, and Brent Seiler, FSA, MAAA, are actuaries in the Midwest Region of Anthem Blue Cross Blue Shield. They can be reached at Keith.Passwater@ Anthem.com and Brent.Seiler@ Anthem.com, respectively.