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Predictive Modeling NEWS

Healthways Details Tools for Targeting Patients for Intervention

Identifying the right individuals at a time when prevention is possible is the key

by Russell A. Jackson

"Five principal rules govern healthcare costs within a total population and should guide the targeting of care management interventions. Predictive modeling can improve the targeting of care management programs by mathematically determining the likelihood of defined outcomes." That's according to "Maximizing Care Management Savings Through Advanced Total Population Targeting," from a recent issue of *Outcomes & Insights in Health Management*, a publication of Healthways Inc.'s Center for Health Research. Here are excerpts, providing a look at how Healthways defines those rules and at how it uses predictive modeling to find the right candidates for effective intervention.

There are five rules of healthcare costs.

[1] *Cost distribution across a population is static*. Segmenting a population into spending brackets from year to year shows that the percent of the population within each bracket remains relatively constant over time. Healthcare spending is low for the majority of individuals and high for relatively few. Healthcare costs for individuals are not normally distributed around the population mean, because individuals with exceedingly high costs – the outliers of the population – skew the average cost upward.

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In This Issue

Leading Healthcare Actuaries Announce Advanced Risk Adjustment for the Road Ahead

Better guidance on insurance decisions with a focus on results

Contributed by Milliman Inc.

As the government orchestrates new policies to reform healthcare, it is imperative that health plans and providers become more strategic about risk evaluation and management. Simply having business intelligence tools that serve up cost and utilization data -- or simply having older risk adjustment methods that produce one relative risk score on an individual -- is no longer an adequate solution. If reform requires plans to accept all applicants, adequate risk recognition becomes imperative. An inadequate system of risk adjustment could put health plans at a disadvantage under proposed health reform scenarios. Plans and their at-risk providers need only take a lesson from the Medicare Advantage program. Despite payments made for risk selection, boosting income from the federal government has proved difficult. Currently, Medicare risk adjustment models serve up just one overall risk score that explains only 11% of spending[1], reflecting risk that can be as stale as 18 months old.

Whether health reform passes or not, plans and providers are calling for better risk adjustment tools coupled with the expertise to make the best use of them. Health plans are investing in new approaches to manage risk; those new approaches require more insight than ever before. Important risk management strategies that will benefit from improved risk adjustment include underwriting and provider payment reforms and cost and care management efforts. Delivery system redesign, such as medical homes and accountable care programs, requires risk adjustment that is guided by highly qualified risk management expertise.

Despite huge investments in business intelligence tools, many plans remain data-rich and insight-poor. According to William Bluhm FCA MAAA FSA, a leading health actuary and modeling expert with Milliman's Minneapolis practice, "we developed Milliman Advanced Risk Adjusters, or MARA, because clients told us they wanted better guidance on insurance decisions -- particularly those affecting underwriting, rate setting and provider payment arrangements. We responded by improving on standard risk adjusters, through a focus on results that are more valuable to the working health plan."

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Modeling Episode Payment for the Patient-Centered Medical Home

A new simulation tests whether rewarding physicians for keeping patients healthy can work

Ideally, says Guy D'Andrea, founder of and president at Discern Consulting, based in Baltimore, the patient-centered medical home concept should be a win-win-win -- for patients, physicians and healthcare purchasers. "Patients benefit by avoiding complications and achieving better health outcomes," he explains, "and purchasers from lower health costs. Physicians who help patients stay healthy should benefit by increased reimbursement." Episode payment, he adds, is one payment method that rewards physicians who adopt a PCMH approach.

To test the proposition that physicians can benefit under such a payment system, Discern Consulting, in partnership with Prometheus Payment, built a simulation of a primary care physician practice called the Chronic Care ECR Estimator. The ECR Estimator is an Excel-based model used to simulate a population of chronically ill patients being treated in a patient-centered primary care practice. Whenever possible, the data in the ECR Estimator are based on analysis of a large database for a commercially insured population. For example, the average fee-for-service costs and the prevalence of chronic conditions and associated risk factors are all based on that database. The model can be used to assess the financial impact of episode payment on a primary care practice, including:

"Physicians who help patients stay healthy should benefit by increased reimbursement."

- effects of population risk on financial outcomes;
- break-even complications rates; and
- optimizing investments to implement PCMH to improve care and reduce complication rates.

Implementing appropriate payment structures is critical to the adoption of the patient-centered medical home, D'Andrea comments. "Episode payment offers a possible solution to the challenge, because it aligns incentives with the goals of the medical home -- investing in prevention and primary care to avoid health complications that lead to poor outcomes and higher costs." A recent paper called "Sustaining the Medical Home: How Prometheus Payment Can Revitalize Primary Care" describes and analyzes how episode payment can work in a medical home setting. For the paper, which was funded by the Robert Wood Johnson Foundation, D'Andrea created a financial model that estimates costs and payment under both fee-for-service and episode payment. Overall, the results of the model support the idea that Prometheus can align incentives so that physicians have an incentive to keep patients healthy and out of the hospital; adjust for risk so that physicians do not have an incentive to avoid riskier patients; and increase physician payment while yielding net savings from fewer complications.

D'Andrea offered details at the recent National Predictive Modeling Summit. Here are highlights:

Several principles characterize the patient-centered medical home, including:

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- a personal physician,
- physician-directed medical practice,
- whole-person orientation,
- care that is coordinated and integrated,
- quality and safety,
- enhanced access and
- payment, which is key to all the other principles.

The current fee-for-service payment methodology is not aligned with the medical home concept. Under the Prometheus episode payment model, the one D'Andrea tested, providers are paid a global evidence-informed case rate – an ECR – to care for a patient. That payment is based on the patient's health status and is adjusted for age, sex, presence of chronic illness and health history. A global fee covers all services recommended by clinical guidelines.

The payment total includes potentially avoidable complications; indeed, half of the total predicted PAC costs are added to the base global ECR fee, creating an incentive for providers to help patients avoid complications. If the PAC costs are less than predicted, the provider spends less and keeps the remainder. If PAC costs are higher than predicted, the provider will spend more and potentially lose money. In other words, D'Andrea points out, "a *de facto* warranty is created."

The key questions related to the impact of ECR payments are the impact of population health status, or probability risk; the impact of complication rates and their costs on the system, or technical risk; and the potential for financial benefit. "We built a model to analyze those issues," D'Andrea says. It assumed 2,000 patients in a primary care practice, 500 of whom were chronically ill. That was broken down into 310 patients (62%) with hypertension, 70 patients (14%) with coronary artery disease, 50 patients (10%) with diabetes, 35 patients (7%) with asthma, 25 patients (5%) with chronic obstructive pulmonary disease and 10 patients (2%) with congestive heart failure.

Further, each patient was modeled as an individual. One example is a hypothetical 60-year-old female whose medical risk factors include uncontrolled diabetes; thyroid disorders; a need for home, transportation and other ancillary services; and a need for visual and hearing aids and other durable medical equipment. Her pharmacy risks included insulin use, use of other anti-diabetics, use of cardiovascular agents and use of statins and other anti-lipid agents. The process used to "create" that patient was replicated for each of the 500 chronically ill patients, thus generating a patient population that a typical primary care physician might treat.

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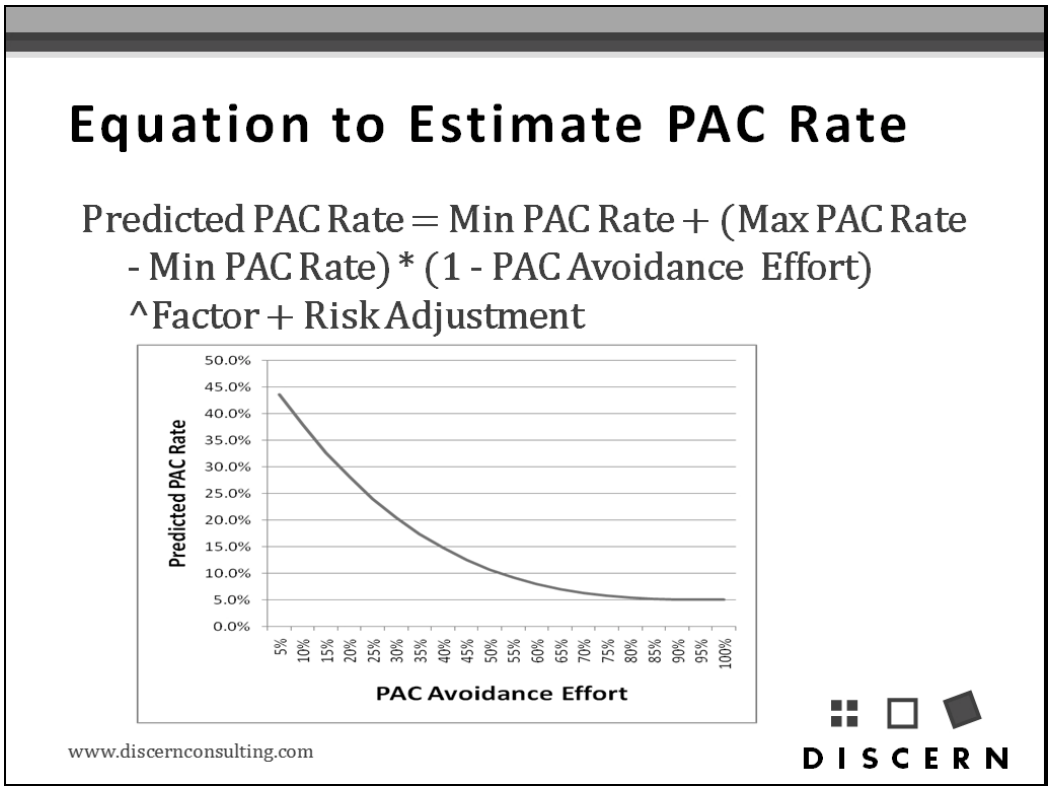
Modeling Episode Payment*...continued*

Parameters for each patient included age, gender and whether certain risk factors were present. The risk factors included are those that were found to have a significant impact on total costs based on the analysis of the commercial insurance database. While each patient was randomly generated, the probabilities for each parameter followed the probabilities observed in the commercially insured population. For example, each chronic disease has a certain age distribution, and each risk factor has a certain probability associated with the patient's age. For each patient, D'Andrea's model calculated expected fee-for-service payment and the Prometheus ECR payment. The model then "sums up both across the population," assuming the ECR payment will be higher because it includes an allowance for PACs. The difference is the "bonus potential" and, D'Andrea notes, "the bonus potential minus the PAC costs minus the investment to reduce PACs equals the actual bonus." In D'Andrea's test, running 1,000 iterations of the ECR Estimator, the physicians' total Prometheus bonus potential turned out to be $541,339, with a standard deviation of $7,610. The variation is due to random fluctuations in patients' risk profiles.

For the ECR Estimator, D'Andrea's calculations accounted for two types of investments to reduce PACs. Physicians may make a fixed-cost investment that impacts the care received by all patients. Adding an electronic medical record system is an example of such an investment. Physicians may also make variable per-patient investments, and the amounts of those investments may be different for each chronic condition. For example, the physician might spend $1,000 per patient to reduce PACs in CHF patients, because PACs for those patients tend to be very expensive. The physician might spend less per hypertension patient, because related PACs cost relatively less.

> "In some ways, the equation expressed in the chart addresses the great unknown of healthcare quality improvement: How do investments in systems of care translate into actual improvements in patient outcomes and cost reduction?"

"It is at this point that we leave the empirical aspects of the ECR Estimator and enter the theoretical," D'Andrea says. "Specifically, we need to predict the physician's PAC rate for each of the chronic conditions, given the physician's investment to avoid PACs and the characteristics of the population." The chart below shows the equation the model uses to estimate the PAC rate:



In that chart, D'Andrea notes, the max PAC rate is the current PAC rate, because physicians won't get worse at avoiding PACs under a payment system that rewards them for reducing PACs.

The minimum PAC rate is above zero because physicians cannot prevent every PAC.

The PAC avoidance effort equals the percentage of the potential bonus that the physician invests in reducing the PAC rate, including both fixed and variable investments.

"That's admittedly a difficult variable to quantify," D'Andrea notes, "and our method may not capture intangible efforts by the physician.

However, real quality improvement will demand new systems and tools, and those require financial investment. The maximum PAC avoidance effort is 100%, but physicians will not want to make that level of effort, as it would mean all of the potential bonus has been expended." The predicted PAC rate is a function of how much the physician invests in avoiding PACs. That's a non-linear relationship, with diminishing returns as the PAC rate approaches the lower limit. "In other words," D'Andrea explains, "some PACs may be easily avoidable, and those will yield to even modest investments. The next round of PAC avoidance will be harder to achieve and will require more investment and so on." In the chart, the "factor" reflects the non-linearity of the effort to reduce PACs.

"For the model," D'Andrea says, "we set the 'factor' value at 2, although future research may help to calculate a more precise value." The PAC rate is adjusted based on the riskiness of the population.

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Modeling Episode Payment...*continued*

"In some ways, the equation expressed in the chart addresses the great unknown of healthcare quality improvement: How do investments in systems of care translate into actual improvements in patient outcomes and cost reduction?" D'Andrea points out. "While we cannot claim that our PAC rate equation answers the question definitively, we do assert that it has the correct properties that one would expect from any such equation."

He continues: "We set up the model to run through 1,000 iterations. In each, the physician's investment in avoiding PACs varied randomly between $0 and $500,000. Recall that the average total bonus potential was about $540,000. A physician investing $0 would be making no effort to reduce PACs, while a $500,000 investment would represent a very significant effort, as it would consume almost the entire potential bonus. Each iteration of the model also generated a new patient population; while the underlying probabilities remained the same, random variation meant that some patient populations had more risk factors present than others. While such riskier populations have higher bonus potentials than average populations – because the Prometheus ECRs are adjusted based on patient risk and complexity – they also have a higher probability of PACs and the higher costs associated with them."

For each iteration, the key output was the physician's net bonus. "Recall that the potential bonus is the difference between the Prometheus ECR payment for all the patients and what the physician would have received under fee-for-service payment," D'Andrea goes on. "The net bonus is the potential bonus minus any investments the physician makes to prevent PACs and any costs for treating those PACs that do occur. Over 1,000 iterations, the average net bonus was about $57,500, with a standard deviation of $43,000. The maximum net bonus was $105,000, and the worst outcome was negative $64,000; that is, in that iteration, the physician was $64,000 worse off than under fee-for-service. Those initial results suggest a high volatility, with the standard deviation being very large."

What's driving that volatility? First, look at population risk. Are physicians with a riskier population losing money, while physicians lucky enough to get a healthy population are making money? A glance at a scatter plot of net bonuses as a function of population risk shows that's not the case. Indeed, visual examination of the scatter plot suggests there is little if any relationship between the count of the total number of risk factors in the population and the physician's net bonus, a conclusion confirmed by the very low r-square number in the scatter plot. "It appears that Prometheus Payment's adjustment for riskier patients is fulfilling its purpose," D'Andrea notes, "and physicians are not better or worse off with a risky or less risky patient population."

If population risk is not driving the variation in net bonus, then what is? Says D'Andrea: "Look at the physician's efforts to prevent PACs. There is a connection between the physician's investment to reduce PACs, which is one of the inputs for our PAC prediction equation, and the physician's net bonus." What produces the connection? "At very low PAC prevention efforts, the PAC rate is not reduced significantly and the physician ends up spending a lot of money treating PACs, which consumes most of the potential bonus.

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Modeling Episode Payment...*continued*

As the physician's PAC prevention efforts increase, the PAC rates and costs go down, so the net bonus increases." However, he adds, "past a certain point – about $240,000 – the physician is spending too much on reducing PACs. That is, the money spent preventing PACs is more than the money it would have cost to treat the PACs themselves."

He concludes: "Armed with that knowledge, we can then ask: What is the volatility of the physician's net bonus when the PAC investment is optimized? To answer that question, we ran another thousand iterations of the model, setting the PAC prevention investment to $240,000 instead of allowing it to vary randomly. The results: The average net bonus was $102,000, which is very close to the maximum net bonus we observed for the previous simulation. Perhaps more importantly, the standard deviation was $2,350, suggesting that physicians who optimize their PAC prevention efforts would have a high confidence of achieving the average net bonus of about $6,000."

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Leading Health Care Actuaries Announce
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With hundreds of years of risk management experience among them, industry-leading Milliman actuaries are responding to customer needs with a new suite of risk adjusters.

Jonathan Shreve FSA MAAA, a co-founder of Milliman's risk adjusters, adds that "the major differences in the way we approach risk adjustment design is how we incorporate actuarial expertise – specifically, health plan-related experience -- in the design of models. We more specifically recognized the markers that might lead to particular conditions."

Milliman's data resources, including its Health Cost Guidelines, are a superior resource relied on by more than 100 insurers. They reflect the latest trends, and they deliver deep healthcare cost information for specific geographic areas, benefits, reimbursement structures and plan characteristics. "We believe MARA will be a better fit for those organizations that want the best predictive power and the most insightful scoring," adds Shreve, who also serves as CEO of Milliman's Care Guidelines.

Milliman Advanced Risk Technologies is the first suite of risk adjusters developed by seasoned healthcare actuaries and the first to offer more information on each individual. MARA has three risk adjusters: RxAdjusters, DxAdjusters and Comprehensive-CxAdjusters.

Each projects individual spending for each of four health service categories. That means that for each pass through any of the prospective models, plans get more information on each individual. "In fact, all the prospective models produce six risk scores describing future expenses, including inpatient, outpatient, physician/professional, total medical, drugs and a total illness burden score," according to Diane Laurent, managing director of Milliman's Advanced Risk Technologies.

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