



**Executive Summary:** *A comparison of Health Risk Monitor to a 2016 study by the Society of Actuaries that compared claims-based tools for health risk assessment shows that HRM continues to lead the industry in clinical predictive modeling.*

## **HCRM Model Improvements Increase Predictive Accuracy**

Health Cost & Risk Management provides clinical predictive modeling using the Health Risk Monitor model. In January 2018, HCRM implemented changes to the HRM model to increase predictive accuracy. Two years of data (8/30/2015-8/30/2017) were used for this process with the first year data used to predict and compare second year actual costs. Revised regression formulas and increased caps on pharmacy and total charge predictions resulted in an increase in accuracy of 11% for total charges and 31% for pharmacy charges.

## **Accuracy Scoring for Predictive Models**

Two key measures of model accuracy are the coefficient of multiple determination,  $R^2$ , and the predictive ratio.  $R^2$  describes the amount of variation in the observed second year costs that were explained by the prediction model.  $R^2$  varies from 0%-100%, that is, from explaining none of the variation in costs to explaining all of the variation in costs for individuals in the population. The predictive ratio, the ratio of the predicted cost of a group over its actual cost, looks at how well the model predicts group costs. The closer that ratio is to 100%, the better the prediction of group costs. Values higher than 100% mean that the prediction is higher than the actual cost; lower means that it underestimates the actual cost. The increases in accuracy reported above are for  $R^2$ . Predictive ratio for the new model for the entire HCRM population is 99.7%.

## **How does the HRM model compare to other claims-based tools for health risk assessment?**

In 2007, the Society of Actuaries (SOA) conducted a study to compare claims-based tools for health risk assessment.<sup>1</sup> They found that the MEDai® model produced the highest  $R^2$  among all models included in the study. An update of this study in 2016<sup>2</sup> did not include the MEDai® model as the corporate parent company was not asked to participate due to the expense associated with SOA licensing the underlying Oracle database needed to run the prediction system. Health Cost & Risk Management acquired the license for the software, renamed Health Risk Monitor (HRM), in 2017.

HCRM compared the HRM model to those evaluated in the 2016 SOA study. To do this, we reran the HRM model using the SOA selection criteria of including only individuals with 12 months data in year 1 and of censoring allowed costs at \$250,000 per individual.<sup>3</sup>

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<sup>1</sup> Winkelman R, Mehmud S (2007) A comparative analysis of claims-based tools for health risk assessment. Society of Actuaries. <https://www.soa.org/resources/research-reports/2007/hlth-risk-assement/>

<sup>2</sup> Hileman G, Steele S (2016) Accuracy of Claims-Based Risk Scoring Models. Society of Actuaries. <https://www.soa.org/research-reports/2016/2016-accuracy-claims-based-risk-scoring-models/>

<sup>3</sup> Censoring limits the influence of extreme outliers; for both the SOA study population and ours, only 0.1% of the population exceeds this cost.



The 2016 SOA study evaluated 10 vendors and 23 prospective models<sup>4</sup>. Models used 1) diagnoses only, 2) pharmacy only or 3) both diagnoses and pharmacy data. Values of R<sup>2</sup> obtained from these 23 models ranged from 11.9% to 27.7%. The models that performed the best used data from diagnoses and pharmacy and also included prior year costs, like the HCRM model. Only four of the 23 models examined were in this category. Their R<sup>2</sup> values along with that obtained from the HRM model using the SOA data selection criteria are shown below.

DIAGNOSIS AND PHARMACY PRIOR COST MODELS	R <sup>2</sup>
<b>Health Risk Monitor (HRM)</b>	<b>30.8%</b>
Verisk Health DxCG Intelligence, v4.3.1	27.7%
Milliman Advanced Risk Adjusters (MARA), v3.6 <sup>5</sup>	26.9%
John Hopkins ACG System, v11.0.1	23.7%
SCIO Health Analytics Prospective Cost of Care Model	22.4%

**How well does the HRM model predict group costs compared to other claims-based tools for health risk assessment?**

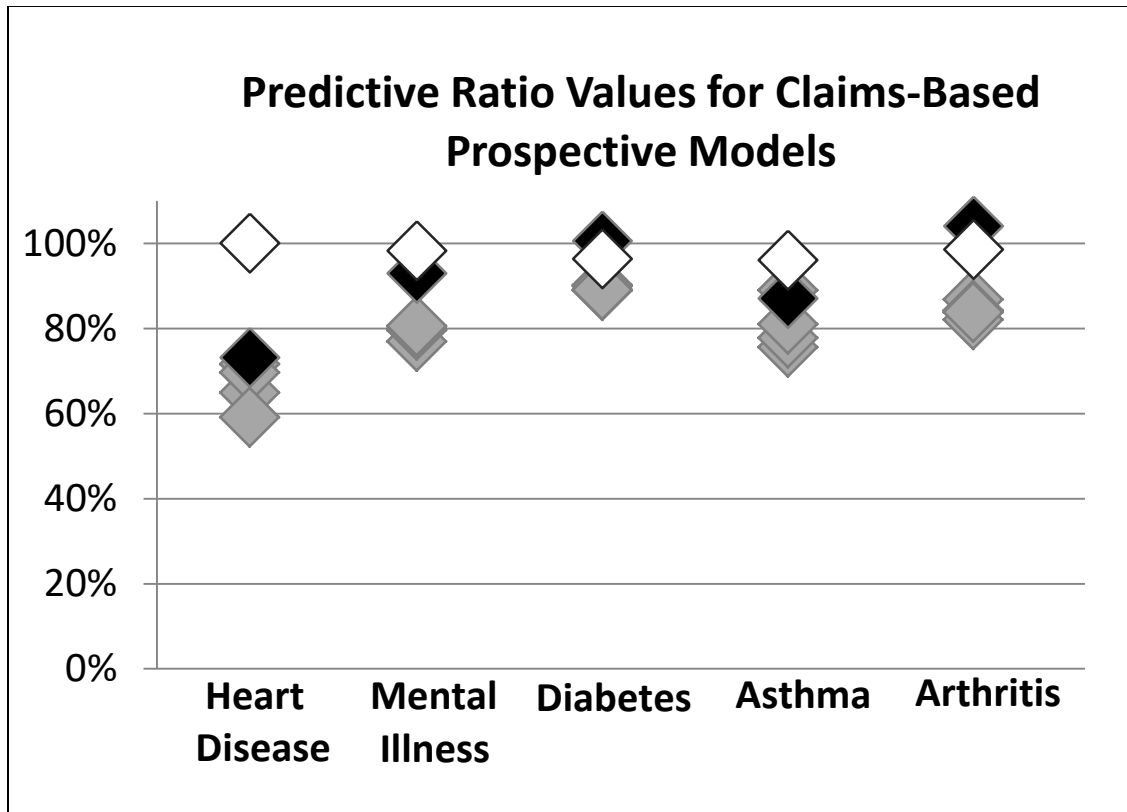
Predictive ratio describes how well the model predicts group costs. Groups evaluated for predictive ratio in the SOA study included heart disease, mental illness, diabetes, asthma and arthritis, all medical conditions with high associated costs. In their study, the “diagnoses and pharmacy” models using prior cost again provided the highest accuracy with predictive ratio values ranging from 59.1% to 90.2% for these conditions. For these same conditions, the HRM model produced predictive ratio values ranging from 96.1% to 100.1%. The large difference in values is at least partly explained by the way individuals are identified with these conditions. Unlike the HRM model in which individuals with these conditions are identified in the first year of data, the SOA models identified the condition in year 2, the prediction year. This will result in an underestimate of costs (a lower predictive ratio) if there are individuals identified with the disease in year 2 who do not show evidence of the condition in year 1. Thus their elevated costs would not be captured in the prediction model.

To make a more direct comparison of the HRM model to the SOA study results, we went back to our model and recalculated predictive ratios for individuals identified with the disease in the second year. These results, as well as HRM model results for individuals identified in the first year, are shown below. It is important to note that identifying individuals in their first year, as done in the HRM model, best predicts future costs for these individuals although it may miss

<sup>4</sup> Prospective models use information from one year to predict medical expenses for the next year, in contrast to concurrent models that use information from one year to explain medical expenditures in that same year.

<sup>5</sup> The MARA model that used diagnoses and pharmacy data but not prior year costs resulted in an R<sup>2</sup> of 27.7.

elevated costs for those individuals identified only in their second year. Despite this, the HRM model best predicts group costs even for those individuals identified only in their second year.



**KEY**

- ◊ HRM model (identifying condition in the 1<sup>st</sup> year)
- ◆ HRM model same condition as SOA Study (identifying condition in 2<sup>nd</sup> year)
- ◊ Models participating in the SOA Study (see table above)

**Health Risk Monitor Continues to Lead the Predictive Modeling Industry in Accuracy**

The HRM system continues to lead the predictive modeling industry by providing the most accurate forecasts at the member and group level. The modeling capability, coupled with a new, graphically-driven user interface, provides customers with the ability to:

- Understand the clinical cost drivers for health plans and its individual members;
- Identify and stratify populations for appropriate intervention;
- Track outcomes for multiple cohorts and the population as a whole.



A more technical description of the modeling improvements including charts from the 2016 SOA study is available. Please contact Rebekah Gumbiner at [rgumbiner@hcrmnet.net](mailto:rgumbiner@hcrmnet.net).

### [About Health Cost & Risk Management, LLC](#)

Health Cost & Risk Management, LLC performs predictive modeling services and specializes in collecting and processing claims and related health plan data for Third Party Administrators, Brokers, Provider Networks, Physician Groups and other clients. HCRM provides monthly predictions of clinical events and associated costs for each member in their database. For each person, the system predicts medical costs, pharmacy costs, emergency room visits and inpatient days for the next 12-month period while also assessing compliance with national standards of care for 19 chronic diseases and four preventive categories. The information is used for disease management, large case management, on-site clinics and others to address the health care needs of their members.

For more information about HCRM and their data driven analytics and reporting capabilities contact Rebekah Gumbiner at 260-255-8560 or email at [rgumbiner@hcrmnet.net](mailto:rgumbiner@hcrmnet.net)