

# Rising risk: Maximizing the odds for care management

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Most healthcare organizations already know which members are currently costly, but what about one year from now? What if future high-risk and high-cost members could be identified before they incur those costs?

Healthcare organizations often seek to prevent high cost medical events while improving the quality of care. As a recent paper from Stanford University noted, “proactively identifying and managing care for high-cost patients – especially cost bloomers, who may disproportionately benefit from interventions to mitigate future high-cost years -- can be an effective way to simultaneously improve quality and reduce population health costs.”<sup>1</sup> The MARA Rising Risk model arose from the need for a more precise method to proactively identify individuals for early intervention and care management that promotes appropriate and efficient use of limited resources. Rising Risk specifically focuses on predicting the individuals who are likely to have greater health care needs and higher expenditures near term, as compared to the current level of expenditures.

In this analysis, we examine predictive models to determine if an enhanced model can better identify individuals with rising risk relative to traditional prospective risk adjustment models. We evaluate the ability of these models to select members whose costs increase in the future year. We found that a model that is specifically tuned to predict rising risk is an improvement for case selection and it outperforms traditional prospective risk adjustment models.

If we consider the transition of members from a current year’s risk level to the next year, there are three options—the risk can increase, decrease, or remain largely unchanged (more precisely, here we mean very minor changes to an individual’s health profile resulting in insignificant changes to the costs in either direction). The chart in Figure 1 illustrates the transition states from one year to the next.

FIGURE 1: TRANSITION IN RISK FROM YEAR 1 TO YEAR 2



A common approach for identifying members for care management and interventions is to focus on the members who are currently high-cost, or expected to be high-cost next year (by using prospective risk adjustment scores). Both approaches cast a wide net that capture both quadrants on the right side of the chart—high-risk members whose risks will be largely the same next year, and members who are currently high-cost but will revert to the mean by next year (decreasing risk cohort). A more refined approach would be to aim to maximize the proportion of members in the top two quadrants—those whose risks will be increasing next year (top left) and high-risk members whose risks will be largely the same next year (top right). There are many existing tools to help care coordinators identify high-cost complex case members in order to reduce the persistent cost levels and prevent further deterioration, but the ultimate goal in care management has been finding the rising risk cohort of the population, implementing early interventions to focus on those members with increasing risk and addressing their additional healthcare needs before their costs escalate.

In order to identify members whose risk levels will likely significantly change in the next year, we decided to develop a more precise method for member selection and stratification. Looking beyond diagnosis data, and even beyond prospective risk scores, we used predictive modeling techniques to identify more complex patterns and markers of the increasing costs – with the goal of identifying members in that top left quadrant.

The resulting model, Rising Risk model of the Milliman Advanced Risk Adjusters™ (MARA™), predicts the change in member risk (and therefore cost), in order to proactively identify members who

<sup>1</sup> PREDICTING PATIENT “COST BLOOMS” IN DENMARK: A LONGITUDINAL POPULATION-BASED STUDY. Available at: [http://statweb.stanford.edu/~ljanson/papers/Predicting\\_Patient\\_Cost\\_Blooms\\_In\\_Denmark-Tamang\\_ea-2016.pdf](http://statweb.stanford.edu/~ljanson/papers/Predicting_Patient_Cost_Blooms_In_Denmark-Tamang_ea-2016.pdf)

are more likely to experience a substantial change in cost, relative to their current cost levels.

The next step was to test how different (and effective) these various methods of member selection and stratification are when you compare them side by side, using a single population. We considered the following three member selection methods that are commonly used:

1. **Method 1:** Select members with highest costs in a given year. This is the simplest method that does not require any advanced analytics and would be available to anyone with access to annual cost data for a population. Rank members from highest to lowest cost incurred in the most recent 12-month period, and select the top 15% for care management.<sup>2</sup>
2. **Method 2:** Select members with highest prospective risk scores. This is a more sophisticated approach (and the most commonly used), where prospective risk adjustment is used to rank members from highest to lowest risk scores, and select the top 15% for care management.<sup>1</sup> Prospective risk scores are predictions of resources used in the subsequent 12-month period, and rely on information on the diagnoses (and sometimes prescription medication claims) in a current 12-month period.
3. **Method 3:** Select members identified by the MARA Rising Risk model. The model outputs a binary flag (1 or 0), indicating which members are most likely to be in the rising risk category. Select these members for care management. The proportion of members flagged as rising risk can range anywhere from 10% to 20%, depending on the population.

## Analysis and results

We used two consecutive years of claim experience for a commercially insured population,<sup>3</sup> and compared the cohorts identified by the three methods by asking the following questions:

- What proportion of each member cohort will actually experience a meaningful increase in cost, a meaningful decrease in cost, or no meaningful change in cost?
- What are the costs for these cohorts in each of the two years, in total and by major service category (inpatient hospital, outpatient setting, professional, and prescription drugs)?
- What is the utilization of services for these cohorts in each of the two years, in total and by major service category?

The answer to the first question is presented in the charts in Figure 2.

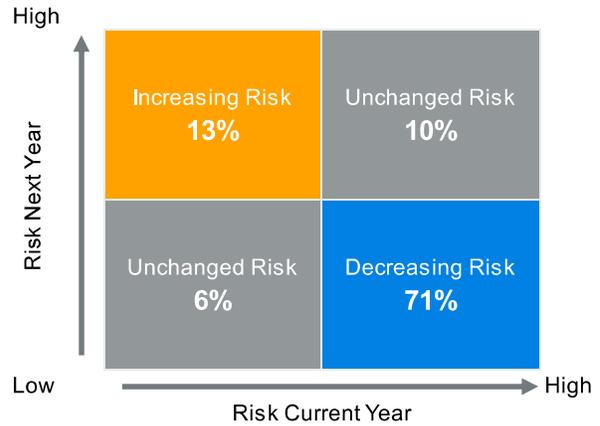
<sup>2</sup> 15% was used in this analysis, and can certainly vary with the size of a population and the distribution of costs.

<sup>3</sup> The case study analysis was run using Truven Marketscan data. Membership and claims were limited to members with 24 consecutive months of eligibility.

**FIGURE 2: DISTRIBUTION OF MEMBERS SELECTED FOR INTERVENTIONS UNDER EACH METHOD**

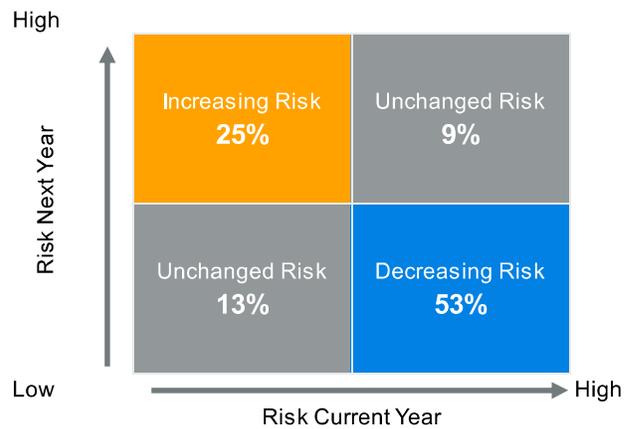
**Method 1:**

Members with Highest Actual Cost



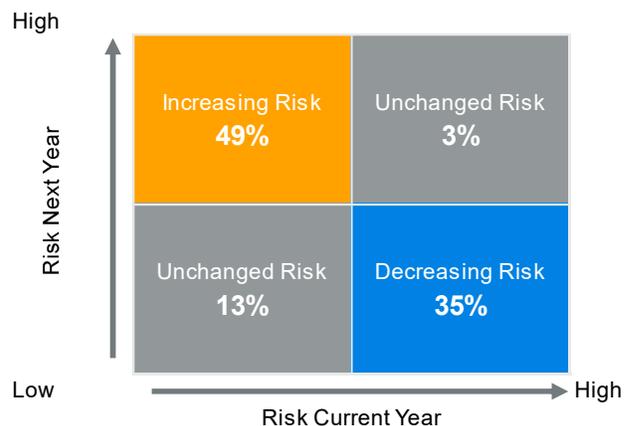
**Method 2:**

Members with Highest Prospective Risk Score



**Method 3:**

Members with Rising Risk Flag



Targeting either the highest-cost (method 1) or the highest-risk (method 2) members identifies complex members with either many diagnoses or high-cost events observed during the most recent year. As a result, a large portion of these member cohorts (71% and 53%, respectively) are expected to experience a regression in cost over the next 12-month period, particularly after undergoing a one-time high-cost procedure or recovering from an acute condition. The MARA Rising Risk model (method 3), however, projected the highest proportion of members with increasing risk (49%) and the lowest proportion of members with decreasing risk (35%), both of which could enhance the efficiency of care management member selection.<sup>4</sup>

To answer the last two questions about the magnitude of costs and utilization, we compared current and following year costs to evaluate how the costs changed between the two years. This information is presented in the tables in Figures 3 and 4 for each of these three cohorts during two consecutive years.

**FIGURE 3: AVERAGE ALLOWED COSTS FOR SELECTED COHORTS**

**METHOD 1: MEMBERS WITH HIGHEST ACTUAL COST**

	AVERAGE PMPY			
	YEAR 1	YEAR 2	Δ \$	Δ %
	[1]	[2]	[3]	[4]
IP	\$6,380	\$2,945	(\$3,435)	-54%
OP / PROFESSIONAL	\$10,846	\$8,080	(\$2,767)	-26%
ER	\$589	\$205	(\$385)	-65%
RX	\$3,470	\$3,525	\$55	2%
ALL SERVICES	\$21,286	\$14,754	-\$6,531	-31%

**METHOD 2: MEMBERS WITH HIGHEST PROSPECTIVE RISK SCORE**

	AVERAGE PMPY			
	YEAR 1	YEAR 2	Δ \$	Δ %
	[1]	[2]	[3]	[4]
IP	\$4,864	\$3,388	(\$1,476)	-30%
OP / PROFESSIONAL	\$9,093	\$8,563	(\$530)	-6%
ER	\$458	\$205	(\$253)	-55%
RX	\$3,780	\$3,890	\$109	3%
ALL SERVICES	\$18,195	\$16,045	-\$2,150	-12%

**FIGURE 3: AVERAGE ALLOWED COSTS FOR SELECTED COHORTS (CONTINUED)**

**METHOD 3: MEMBERS WITH RISING RISK FLAG**

	AVERAGE PMPY			
	YEAR 1	YEAR 2	Δ \$	Δ %
	[1]	[2]	[3]	[4]
IP	\$167	\$1,566	\$1,399	838%
OP / PROFESSIONAL	\$1,910	\$3,897	\$1,987	104%
ER	\$106	\$108	\$2	2%
RX	\$1,362	\$1,551	\$189	14%
ALL SERVICES	\$3,544	\$7,121	\$3,577	101%

The first striking difference in the Year 1 cost levels (column [1]) is rather obvious—the rising risk cohort members are lower-cost members (~\$3,500 per member per year [PMPY]), and the other two cohorts captured the most expensive members with the highest cost of over \$18,000 and \$21,000 PMPY. For a point of reference, the Year 1 cost in the entire population sample from which the three cohorts were selected was just over \$4,600 PMPY.

Total average cost PMPY doubled (increased by over 100%) for the rising risk cohort in Year 2 (~\$7,100, see column [2]), while total average cost for the highest current cost and highest prospective risk score cohorts decreased. While emergency room (ER) costs stayed level for the rising risk cohort, these costs dropped significantly (more than 50%) for the other two cohorts. The costs for outpatient hospital and professional services increased by more than 100% for the rising risk cohort, which equated to the largest increase in average cost in absolute dollar amount across all service categories. However, it is the change in the inpatient hospital cost for the rising risk cohort that is most significant and noteworthy, with an 838% increase in average cost, particularly when contrasted with a large drop in inpatient costs in the other two cohorts (-54% and -30%, column [4]).

We then broke down the overall cost per member per year into utilization (see columns [5] – [8]) and cost per patient (see columns [9] – [12]), in order to understand the driver behind the change in cost (see Figure 4 below). The notable changes in inpatient costs mentioned above can be attributed primarily to the change in utilization of these services in Year 2. While both the rising risk and current year high-cost cohorts showed an increase in inpatient costs per patient in Year 2 (column [11]), indicating hospital admissions of higher severity, the utilization of inpatient hospital by the rising risk cohort increased dramatically as well (columns [7] and [8]). The utilization of inpatient hospital by the highest-cost and highest-risk cohorts decreased significantly, as one might have expected (columns [7] and [8]).

<sup>4</sup> Rising Risk members were identified as those with a ratio of Year 2 to Year 1 costs greater than 1.5. Falling Risk members had Year 2 to Year 1 cost ratios less than 0.90. Unchanged Risk members had Year 2 to Year 1 cost ratios between 0.90 and 1.5.

**FIGURE 4: COSTS AND UTILIZATION BY PATIENT FOR SELECTED COHORTS****METHOD 1: MEMBERS WITH HIGHEST ACTUAL COST**

	COUNT OF PATIENTS WITH SERVICE				COST PER PATIENT			
	YEAR 1	YEAR 2	Δ \$	Δ %	YEAR 1	YEAR 2	Δ \$	Δ %
	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
IP	35,751	11,700	(24,051)	-67%	\$17,604	\$24,831	\$7,226	41%
OP / PROFESSIONAL	98,430	95,829	(2,601)	-3%	\$10,869	\$8,317	(\$2,553)	-23%
ER	37,284	18,336	(18,948)	-51%	\$1,559	\$1,101	(\$458)	-29%
RX	90,193	86,559	(3,634)	-4%	\$3,795	\$4,017	\$222	6%

**METHOD 2: MEMBERS WITH HIGHEST PROSPECTIVE RISK SCORE**

	COUNT OF PATIENTS WITH SERVICE				COST PER PATIENT			
	YEAR 1	YEAR 2	Δ \$	Δ %	YEAR 1	YEAR 2	Δ \$	Δ %
	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
IP	21,123	14,878	(6,245)	-30%	\$22,713	\$22,461	(\$253)	-1%
OP / PROFESSIONAL	98,331	97,317	(1,014)	-1%	\$9,121	\$8,679	(\$442)	-5%
ER	30,785	18,706	(12,079)	-39%	\$1,467	\$1,081	(\$386)	-26%
RX	89,906	88,609	(1,297)	-1%	\$4,147	\$4,330	\$183	4%

**METHOD 3: MEMBERS WITH RISING RISK FLAG**

	COUNT OF PATIENTS WITH SERVICE				COST PER PATIENT			
	YEAR 1	YEAR 2	Δ \$	Δ %	YEAR 1	YEAR 2	Δ \$	Δ %
	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
IP	2,437	7,079	4,642	190%	\$5,526	\$17,838	\$12,312	223%
OP / PROFESSIONAL	68,968	69,104	136	0%	\$2,233	\$4,548	\$2,315	104%
ER	9,344	10,276	932	10%	\$914	\$847	(\$67)	-7%
RX	57,875	54,141	(3,734)	-6%	\$1,898	\$2,311	\$413	22%

## Next steps for care management

Once a cohort of members has been identified for care management, there are additional steps that can be taken to further stratify and prioritize members within that cohort. Consider a case management application for stratifying a congestive heart failure (CHF) population to identify patients for management.

When selecting members for a CHF disease management program, there is little specificity when simply identifying all members with CHF diagnosis as target participants. In our research data sample of approximately 650,000 individuals, 2,560 members have a diagnosis of CHF. This large number of patients can quickly overwhelm Disease Management (DM) staff with limited resources to assess and manage this population. To be more specific for both staff planning and addressing member needs, care managers could instead focus primarily on those CHF members who are more likely to experience a meaningful

increase in cost by adding the Rising Risk flag, which yields a more manageable 924 members. Using the additional data and indicators provided by MARA, these 924 members can further be examined and prioritized by risk strata as shown in Figure 5, and first priority given to those members in the highest risk strata, for example.

**FIGURE 5: BREAKDOWN OF CHF RISING RISK MEMBERS**

CURRENT RELATIVE RISK CATEGORY	NUMBER OF CHF RISING RISK MEMBERS
VERY HIGH RISK	218
HIGH RISK	456
AVERAGE RISK	208
LOWER THAN AVERAGE RISK	40
VERY LOW RISK	2

## Conclusion

There is certainly no single method when it comes to member stratification for care management. While it is only natural to focus attention on the highest cost members (the 20% in the 80/20 rule<sup>5</sup>) in order to reduce those costs, focusing on members who will regress to the mean can be inefficient. Rising Risk prediction can prioritize the remaining 80% of the population more efficiently to identify the opportunity cases. An example of this can be seen in a recent study in [Health Affairs](#), which found that the cost reductions “among 2013 MSSP [Medicare Shared Savings Program] entrants were almost entirely concentrated among lower-risk patients.” While this study highlights findings in a Medicare population specifically, the concept is worth exploring for other populations and is consistent with characteristics of cohort of members identified using Rising Risk model in this analysis. Using advanced analytics such as Rising Risk model offers a fresh perspective on the question of member prioritization and stratification.

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<sup>5</sup> [http://www.commonwealthfund.org/~media/Files/Publications/Issue%20Brief/2011/May/1501\\_Hall\\_risk\\_adjustment\\_ACA\\_guide\\_for\\_regulators\\_ib\\_v2.pdf](http://www.commonwealthfund.org/~media/Files/Publications/Issue%20Brief/2011/May/1501_Hall_risk_adjustment_ACA_guide_for_regulators_ib_v2.pdf)



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