



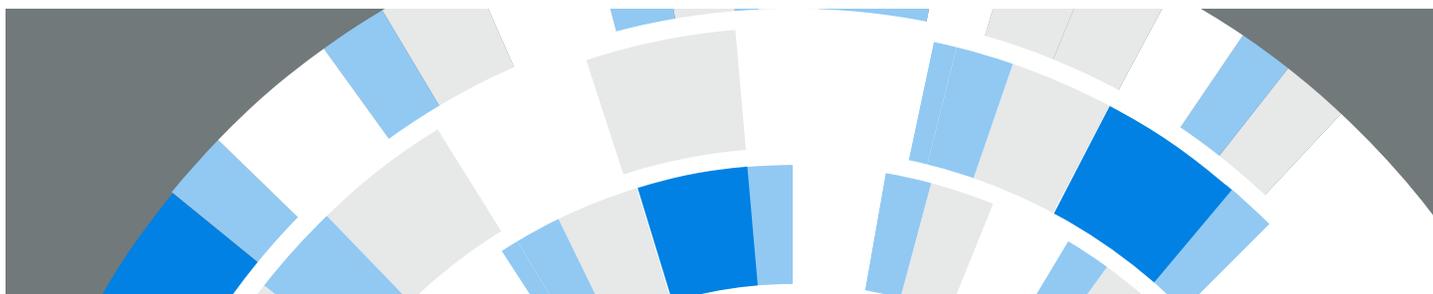
Milliman Advanced Risk Adjusters (MARA)[®]



Milliman has helped customers manage their businesses in uncertain times for more than 70 years. The healthcare reform environment is no exception. We continue to lead the industry by adding more value to analytical opportunities with advanced risk adjustment, predictive models that specify rising risk, and tools for case managers.

Decision confidence

Milliman Advanced Risk Adjusters (MARA)[®] offers an effective approach to population health risk assessment with models that perform better, deliver more intelligent scoring, and offer greater clinical transparency. MARA is the engine that can fuel health risk assessment and help customers make confident decisions in today's challenging healthcare arena.



MARA is a risk adjustment system that considers disease progression and leverages advanced statistical methods. Highly effective scoring and clinical classification systems enhance analytic capabilities. Whether you are replacing an outdated product or adopting risk adjustment anew, MARA can give you deeper insight so you can develop more accurate pricing, improve loss ratios, increase profitability, and more effectively manage healthcare populations.

MARA is different. The MARA models are designed by a collaborative team of physicians and actuaries who incorporate medical code classifications into a system that can accurately and efficiently estimate medical risk. This classification system has successfully supported medical underwriting decisions for more than 15 years.

MARA is the right choice for risk action decisions that create bottom-line opportunities. MARA's unique features will separate the winners from the losers so you can meet today's challenges head on:

- **Intelligent scoring** – Provides greater insight for resource planning by health services categories
- **Proven clinical classification system** – Offers enhanced detail and is easy to understand
- **Transparency and clinical insight** – Explains how conditions are driving individual clinical risk

- **Superior performance** – Offers unsurpassed predictive capabilities
- **Platform independent design** – Provides a flexible and easy-to-operate interface that can be integrated into existing environments
- **Decision confidence** – Offers an Analytic Guide to promote successful application of risk scoring
- **Unparalleled expertise** – Analyze with confidence knowing that a Milliman expert is just a mouse click or a phone call away
- **Tools for Case Managers** – Chronic/non-chronic identifiers, medically complex and frail indicators, risk strata for each model and each score, and tips for using MARA in population health planning and interventions

A proven clinical classification system for predicting risk that also supports medical analytics

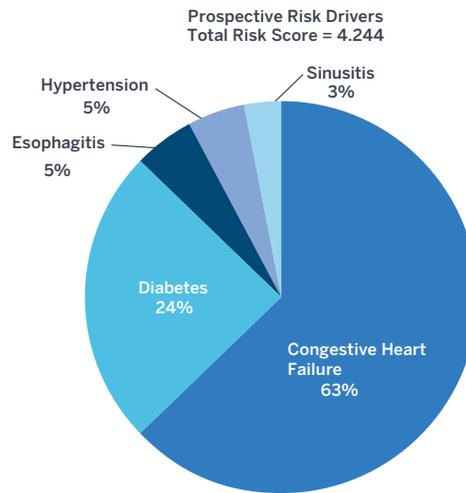
Some risk adjustment systems limit the number of condition groups when developing predictive models. While fewer clinical groups can make it easier to build models, such structures may restrict clinical analysis, patient stratification, and case management workflow. With MARA, you get a system that is both robust and supports a broad range of medical analytics.

More than **1,000** condition groups with clear clinical labels profile medical problems that drive risk:

- ⚠ Anemia
- ⚠ Congestive heart failure
- ⚠ Diabetes mellitus
- ⚠ Hypertension
- ⚠ Osteoarthritis
- ⚠ Pneumonia
- ⚠ COPD
- ⚠ Sinusitis
- ⚠ Retinal Detachment
- ⚠ Injury-rotator cuff
- ⚠ Chest pain
- ⚠ Back pain
- ⚠ Spinal stenosis
- ⚠ Cataracts
- ⚠ Pregnancy

Greater clinical transparency for medical managers

We all know that clinical transparency lends more meaning to risk scores and better support to clinical decisions. MARA's clinical risk drivers offer a fresh approach in population health risk analysis. Specifically, MARA reveals the percent contributions for each disease and medical condition affecting the clinical portion of risk scores. These means you gain a deeper understanding of the data and can make complex case assessment and care support decisions with greater confidence.



Actionable insight for care management workflow decisions

With a total risk score of 4.24, the example individual above is sicker than average—heart disease and diabetes account for more than 50% of the expected risk in the prediction period, but other manageable conditions also influence risk. As you can see, MARA provides a transparent view of clinical risk factors and how they can influence expected costs and resources. Such advanced capabilities make MARA the best choice for clinical risk stratification and workflow decisions. With this knowledge, you can take proactive risk actions that lead to reduced risks and improved quality.

Intelligent scoring expands the value of risk adjustment

A single risk score that captures a member's relative risk as compared with an average population is simply not enough for complex decisions, nor is it necessarily useful for care management. As healthcare decisions become more complex, it is time for risk scoring systems to evolve, too. Customers can depend on MARA for more intelligent scoring.

Every MARA model produces category risk scores that explain the expected resource use for key health service components, including inpatient, outpatient, emergency room, physician, drugs, and other services. MARA can help you get a better handle on the utilization of health services, adjust for risk expectations at the resource level, measure and profile efficiency by service category, and set a more accurate budget. All this makes MARA a most valuable asset for managing decisions under healthcare reform.

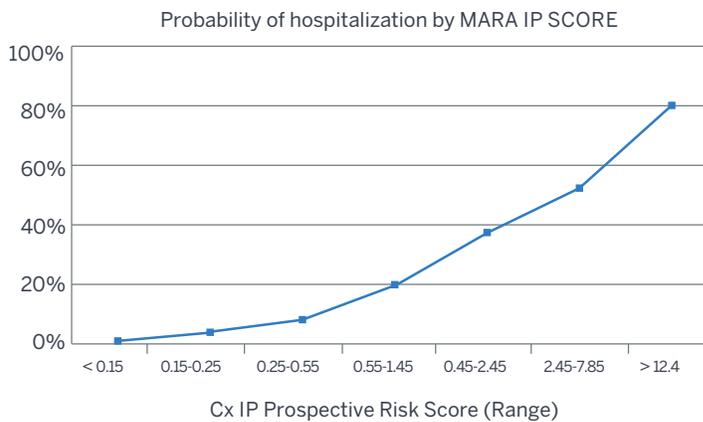
Superior performance

In today’s healthcare environment, the importance of predictive accuracy is striking, especially when the use of millions or even billions of healthcare dollars will be based on risk scores. As performance measures and payments are adjusted for illness burden, model accuracy becomes a valuable asset to any healthcare entity considering payment reforms.

The superior performance of new risk adjustment models like MARA has encouraged the industry to move decisively away from demographic-based premium and payment systems. The predictive accuracy of risk adjustment models is typically judged by the R-squared (R²) statistic or the percentage of variation explained by the model. Other statistics are also important to consider, such as mean average prediction error (MAPE), predictive ratios (PRs), or ratios of the mean predicted to mean actual expenditures for biased subsets of populations, such as a disease cohort, groups of employers, or providers.

Highly correlated inpatient risk scores and admissions

The prospective inpatient (IP) risk score is not only a strong predictor of overall inpatient costs but also does very well in predicting actual admissions.



The findings of an independent pre-post study of admissions showed a strong correlation between MARA’s calculated prospective IP score and the proportion of people with that score who were actually hospitalized. In other words, the higher the IP score, the greater the likelihood of actual hospitalization. When there is a need to reduce hospital admissions, an IP risk score can be a powerful stratification variable for medical management workflow.

Technically friendly, flexible software

MARA is quick to install and highly flexible when a tight integration is needed for automated processing and reporting. System-independent and component-based design allows for deployment in diverse technology environments. The user-friendly design of the MARA software means that no additional third-party products are required for operations.

OPERATING SYSTEM	MARA SUPPORTED	INTEGRATION	MARA SUPPORTED
WINDOWS	✓	.NET API	✓
UNIX	✓	JAVA API	✓
LINUX	✓	WEB SERVICE	✓

MARAs comprehensive profile of risk and clinical information helps you put it all together:

- ✓ Identify scores, conditions, and clinical risk drivers
- ✓ Determine concurrent and prospective risk
- ✓ Transform IP scores to a probability of hospitalization
- ✓ Flag conditions on the STAR or AHRQ list of “avoidable” for admission
- ✓ Convert scores to dollars

The most recent competitive model performance study by the Society of Actuaries, October 2016 Comparison of Claims-based Risk Models prove the value of MARA risk adjustment models when compared with well-known competitors. In nearly every category, MARA outperformed competitor models in critical areas:

- Highest R-Squared and lower MAE
- More model options – pharmacy only, medical only, medical plus pharmacy and prior cost options are available

R-Squared and MAE, concurrent models

	R-SQUARED		MAE	
	UNCENSORED	CENSORED AT \$250K	UNCENSORED	CENSORED AT \$250K
DIAGNOSIS-ONLY MODELS				
ACG SYSTEM	44.1%	52.4%	75.3%	73.3%
CDPS	24.2%	30.0%	92.5%	90.6%
DxCG	52.6%	61.0%	67.6%	65.0%
HHS-HCC	41.3%	45.2%	86.8%	85.5%
→ MARA DxADJUSTER	52.7%	62.6%	64.0%	61.8%
TRUVEN	52.6%	62.7%	64.9%	61.6%
WAKELY	43.2%	51.0%	76.5%	74.3%
PHARMACY-ONLY MODELS				
DxCG	29.6%	38.4%	83.0%	80.8%
→ MARA RxADJUSTER	30.1%	40.1%	81.8%	79.6%
MEDICAIDRx	12.9%	18.0%	100.3%	98.3%
WAKELY	19.9%	28.8%	91.4%	89.2%
DIAGNOSIS-AND-PHARMACY MODELS				
ACG SYSTEM	45.9%	56.4%	70.0%	67.6%
CDPS-MRx	25.6%	32.4%	90.0%	88.1%
CRG	41.0%	49.3%	78.2%	76.2%
→ MARA CxADJUSTER	55.4%	66.7%	57.9%	55.6%
WAKELY	44.3%	54.2%	73.8%	71.3%

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Milliman Advanced Risk Adjuster CONCURRENT Models show the highest predictive accuracy (R-Squared) and lowest error rate (MAE) in the 2016 SOA Risk Adjustment Vendor Study

“MARA’s clinical risk drivers are the ‘jewel’ in helping us understand the effect of medical problems on risk in a way we never understood with other vendors’ tools.”

– PCMH clinical case manager

R-Squared and MAE, prospective models

	R-SQUARED		MAE	
	UNCENSORED	CENSORED AT \$250K	UNCENSORED	CENSORED AT \$250K
DIAGNOSIS-ONLY MODELS				
ACG SYSTEM	16.2%	21.0%	100.7%	98.7%
CDPS	9.1%	11.9%	109.2%	107.5%
DxCG	18.6%	23.8%	98.9%	96.9%
IMPACT PRO	18.9%	22.8%	98.2%	96.2%
→ MARA DxADJUSTER	20.1%	24.9%	97.3%	95.3%
TRUVEN	20.7%	26.4%	96.4%	94.0%
WAKELY	17.0%	21.3%	100.5%	98.6%
PHARMACY-ONLY MODELS				
ACG SYSTEM	11.6%	16.5%	102.7%	100.7%
DxCG	14.8%	19.9%	100.4%	98.4%
IMPACT PRO	13.7%	19.1%	101.6%	99.6%
→ MARA RxADJUSTER	15.1%	20.1%	99.8%	97.8%
MEDICAIDRx	8.6%	12.8%	107.6%	105.7%
WAKELY	9.9%	14.9%	103.9%	101.9%
DIAGNOSIS-AND-PHARMACY MODELS				
ACG SYSTEM	17.2%	23.0%	97.6%	95.5%
CDPS+MRx	10.0%	13.3%	107.0%	105.1%
CRG	17.0%	21.7%	99.6%	97.6%
IMPACT PRO	20.7%	25.8%	94.6%	92.5%
→ MARA CxADJUSTER	22.0%	27.7%	93.3%	91.3%
WAKELY	18.5%	23.7%	97.1%	95.1%
PRIOR COST MODELS				
ACG SYSTEM	17.8%	23.7%	96.7%	94.6%
DxCG	23.8%	27.7%	91.2%	89.1%
→ MARA	24.8%	26.9%	91.8%	90.1%
SCIO	15.1%	22.4%	95.8%	93.5%

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Milliman Advanced Risk Adjuster PROSPECTIVE models outperformed other vendor models in three of the four categories (RxAdjuster, CxAdjuster, Prior Cost)

Numerous independent studies illustrate MARA models are top performers and deliver valuable risk scoring by health service categories.

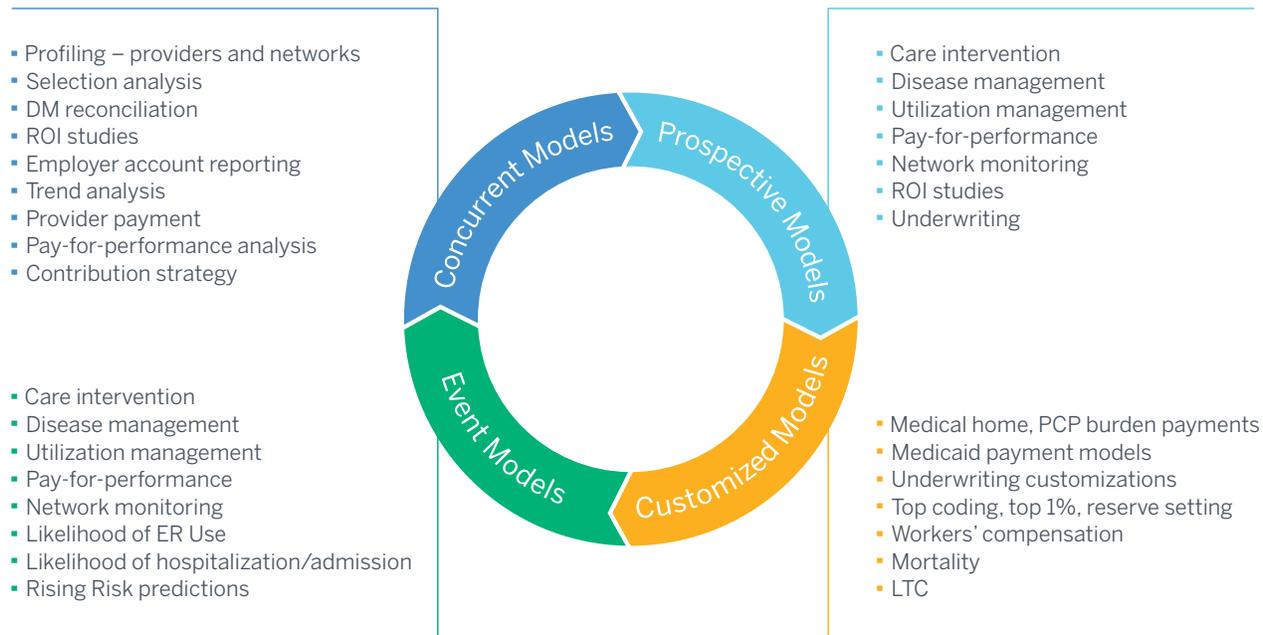
- MARA's IP and ER Risk Scores are highly correlated with the likelihood of hospital admissions for key disease groups
- Better suited for high-cost case predictions

Expert advice for confident applications of risk adjustment

Risk adjusters and predictive models inform a wide range of healthcare decisions and applications, many of which are shown here. Risk adjusters are optimal only when applied effectively. As a full-service actuarial and consulting firm, Milliman brings a comprehensive understanding of the application of risk adjustment and predictive modeling to complex healthcare applications.

Reaching full potential

Whether the need is for risk adjustment tools, strategic advice, or customized models, Milliman's knowledgeable consultants and actuaries are always available to help design and deliver successful solutions.



Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

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Learn more

For more information about MARA or to schedule a demonstration of the software, contact or visit us at:

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