

Milliman Irix[®] –
Risk Score with Credit Data:
Stratifying mortality risk by combining
prescription drug history and credit attributes



Predictive models and life insurance

Munich Re Life US assessed Milliman Irix® – Risk Score with Credit Data, a predictive modeling tool developed and owned by Milliman that assesses mortality risk through the combination of an individual's prescription drug and Fair Credit Reporting Act-compliant credit information. Insurers interested in prescription- and credit-based mortality scores should perform a retrospective validation study using their own experience data. Munich Re can assist carriers with the retrospective study, advise on changes to mortality assumptions, and recommend ways to incorporate the scores to streamline the underwriting process.

Executive summary

Milliman Irix® – Risk Score with Credit Data is a proprietary scoring algorithm that combines prescription drug history and credit attributes to predict the mortality risk of individuals relative to other individuals of the same age and gender.

In 2018, Munich Re assessed Irix® – Risk Score 2.0, a score based on prescription drug history (“Prescription-only Score”), and concluded the scores are predictive of mortality for the U.S. insurance applicant population.¹ Since then, Milliman has incorporated credit attributes to produce the Irix® – Risk Score with Credit Data (“Combined Score”). Carriers currently using Prescription-only Scores typically establish thresholds and decision guidelines to streamline their underwriting process while managing mortality risk.

Milliman provided Munich Re a dataset comprised of 10 million lives sampled from the U.S. general insurance applicant population which includes life, health, LTC, DI, final expense and Medicare supplement lines of business. Life represents the majority of the dataset. Prescription-only and Combined Scores were provided, which range within 0.0 and 10.0.

Munich Re performed an analysis of Risk Score with Credit Data and confirmed it is predictive of mortality for the U.S. insurance applicant population. Compared to a Prescription-only Score, the Combined Score increases the volume of scored individuals and more effectively stratifies mortality risk. A company-specific insured population is not expected to have identical underlying characteristics as this insurance applicant population; Munich Re recommends replicating the study on a company-specific insured dataset to help assess the value of Risk Score with Credit Data.

Life insurers interested in Risk Score with Credit Data should conduct a retrospective study in order to calibrate the tool to the carrier's own underwriting paradigm. This process will help carriers balance the score with the expected mortality of their unique target markets, distribution channels, and underwriting processes. For carriers who are already using a prescription-only or credit-based mortality score, a Combined Score provides a more holistic assessment of mortality.

KEY FINDINGS

Primary high-level findings include the following:

- Risk Score with Credit Data combines prescription history and credit information (“Combined Score”). Relative mortality risks increase as the Combined Score increases.
- Risk Score with Credit Data allows carriers to identify more lives with better mortality compared to a prescription-only Risk Score (“Prescription-only Score”), particularly for ages below 60.
- A Combined Score is provided for an individual with prescription history only, credit information only, or a combination of both. Thus, the number of individuals with an Irix® - Risk Score is greater than when using a Combined Score compared to a Prescription-only Score.
- The Combined Score effectively stratifies mortality risk across age groups. It is more effective at identifying high mortality risk when prescription history is available, except for ages 80 and above.
- The Combined Score is especially effective at segmenting mortality risk for earlier durations, similar to the Prescription-only Score.

Methodology

Munich Re assessed the effectiveness of the new Milliman Irix® - Risk Score with Credit Data in stratifying the mortality risk profile of a pool of 10 million applicants with entry ages 18-90. Each life entered the study between the first quarter of 2013 and the last quarter of 2016. Deaths were sourced from the Social Security Death Master File and third-party proprietary databases. The study population is comprised of 83,744 deaths out of 21 million exposed life-years.

The expected mortality basis was taken from the 2015 VBT primary select and ultimate age-nearest birthday tables split by age and gender with 1 percent historical mortality improvement. We did not have the smoking status of each applicant, so we used an 85 percent non-smoker/15 percent smoker blend of the smoker distinct tables.

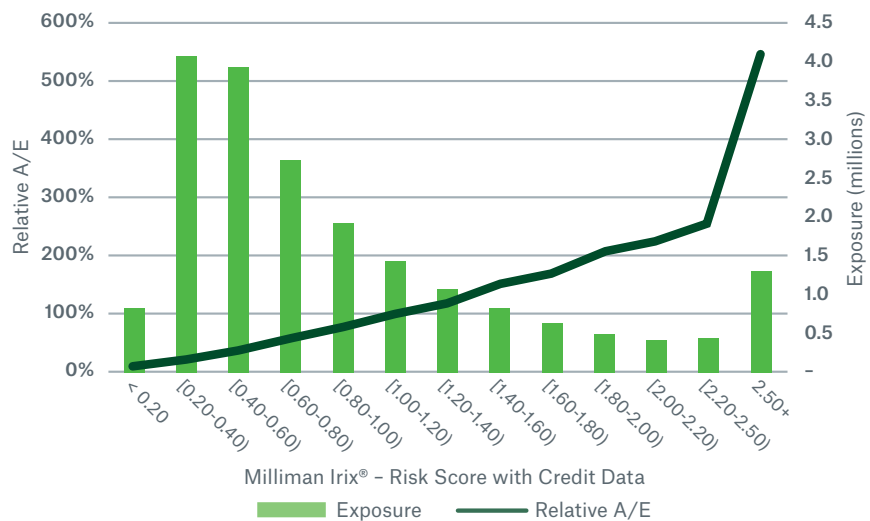
Munich Re completed additional analyses of relative actual to expected ratios (A/E) by various factors (e.g., age, gender, duration, and hit type) to assess whether the mortality risk stratification by Risk Score with Credit Data is influenced by those factors.

Results

Overall results

Figure 1 is a high-level overview validating Milliman Irix® - Risk Score with Credit Data’s ability to stratify mortality risk. Lives with higher scores have higher mortality risk, while lower scores correspond with lower mortality risk.

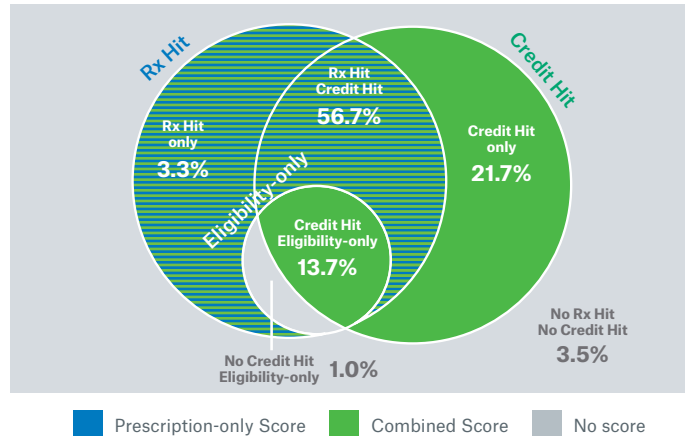
Figure 1. Relative A/E and Exposure vs. Risk Score with Credit Data



Exposure

A combined model produces a score for any combination of prescription history and credit information for a given individual. As illustrated in **Figure 2**, a combined model yields an Irix® - Risk Score for a larger subset of the same population exposure compared to a prescription-only model.

Figure 2. Exposure by Database Hit Type



Compared to a prescription-only model, the use of a combined model increases the percent of total exposure with an Irix® - Risk Score from 60.0% to 95.4%.

Figure 3 shows the exposure distribution of the Combined and Prescription-only Scores. We observe the increase in exposures is the greatest at scores less than 0.6, largely driven by ages below 60. This means that a Combined Score allows carriers to identify more lives with better mortality compared to a Prescription-only Score.

Figure 3. Distribution of Exposure for Risk Score



Database hit type

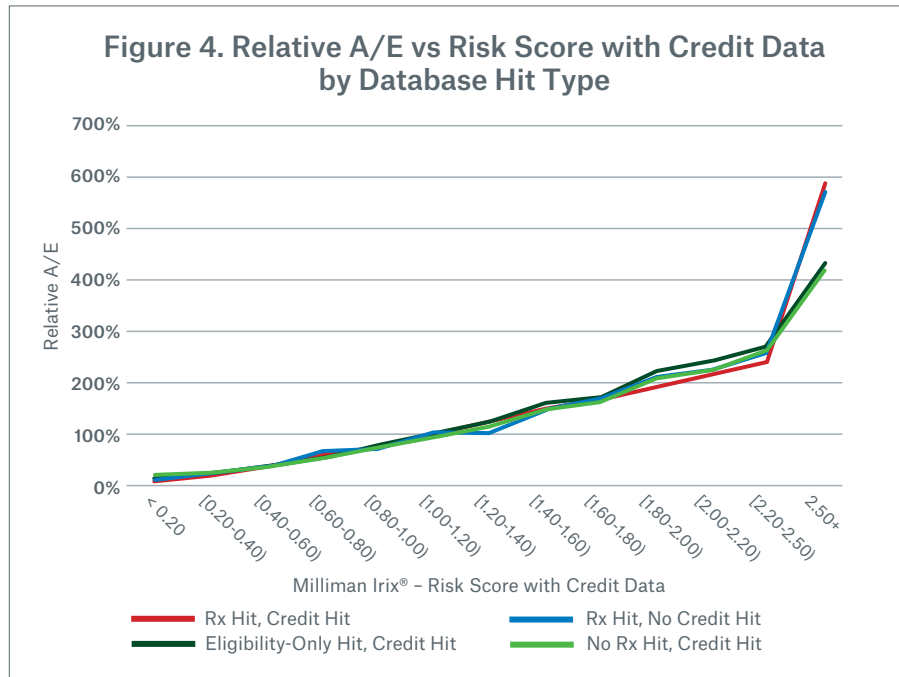
Table 1 summarizes the relative A/E by prescription and credit database hit type. The subset with no hits has higher relative mortality, both for the prescription history and credit databases.

Table 1. Relative A/E by Database Hit Type

Relative A/E		Credit		
		Credit Hit	No Credit Hit	Total
Rx	Rx Hit	95%	128%	98%
	Eligibility-Only	91%	122%	93%
	No Rx Hit	108%	120%	110%
	Total	98%	124%	100%

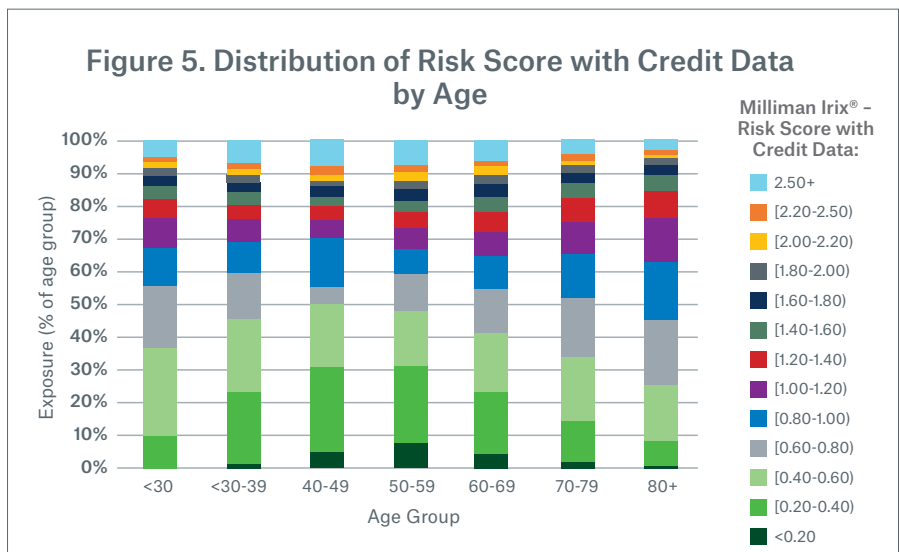
Individuals without a prescription or credit database hit have a higher relative mortality.

Figure 4 illustrates the mortality risk segmentation of the Combined Score across prescription and credit hit types. While the scores provide a similar stratification of mortality across hit types, scores with a prescription hit are more effective at identifying high mortality risks, except for ages 80 and above. This is likely due to a larger accumulation of prescription histories in older ages.



Age

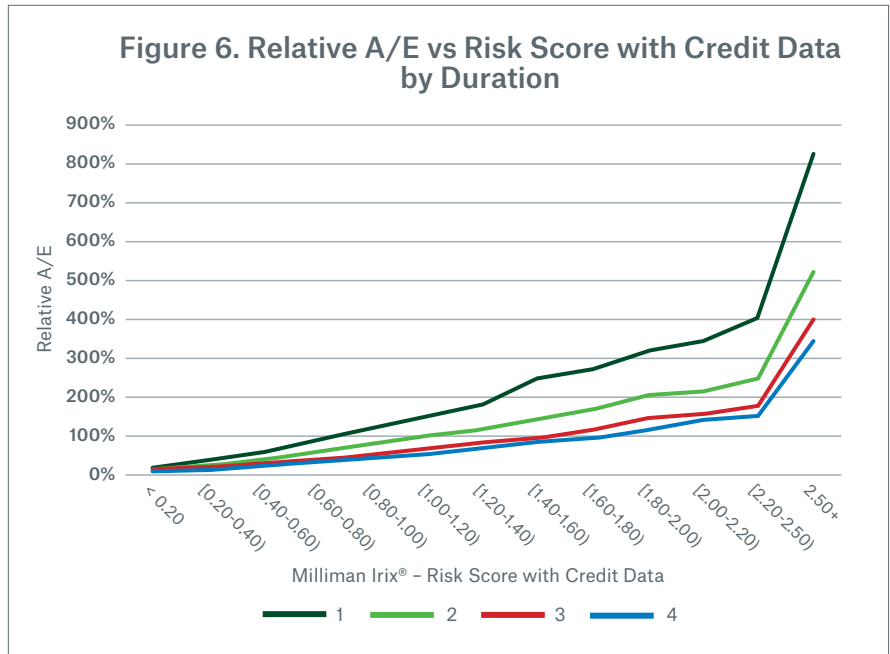
Figure 5 shows the distribution of the exposure within each age group both for the Combined Score; the Irix® - Risk Score is controlled for age and gender. The distribution of scores has a bell-shaped curve. This is a deviation from the distribution of scores for a prescription-only model where the proportion of scores was relatively stable across age groups.



All age groups follow a similar mortality segmentation pattern seen in Figure 3, where mortality risk increases as a score increases. As described in Figure 4, scores with a prescription hit are more effective at identifying high mortality risks, except for ages 80 and above.

Duration

From **Figure 6**, we can see the Combined Score segments mortality across varying durations. Duration is measured as the number of years that have passed since the prescription and credit data was retrieved for a given general insurance applicant. The most effective mortality segmentation is achieved in the first duration. As duration increases, we observe a decrease in mortality segmentation effectiveness, particularly for the high mortality risks. The decrease in mortality segmentation dampens as duration increases, evidenced by the narrowing of relative mortality differences for high scoring lives.



Summary

Munich Re concludes the Milliman Irix® - Risk Score with Credit Data is an effective predictor of mortality for the U.S. insurance applicant population. Compared to its prescription-only predecessor, the Risk Score with Credit Data increases the volume of scored individuals and more effectively stratifies mortality risk across age and duration. The increased volume of scored individuals is largely driven by ages below 60 with low mortality risk.

A score is provided for an individual with prescription history only, credit information only, or a combination of both. While mortality segmentation is effective and comparable across all three cases, the score is more effective at identifying high mortality risk when prescription data is available, except for ages 80 and above.

Finally, a company-specific insured population is not expected to have identical underlying characteristics to this insurance applicant population; we recommend each carrier perform a retrospective study to best assess the value and application of Risk Score with Credit Data. The Risk Score with Credit Data might be particularly effective to identify high mortality risk when less medical data is available, for example in fluid-less underwriting programs.

References

1. Milliman Risk Score 2.0 - stratifying mortality risk using prescription drug information, Munich Re, 2018. <https://www.munichre.com/us-life/en/perspectives/alternatives-for-stratifying-mortality-risk/milliman-risk-score-2-0-prescription-drugs.html>



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