

AN APPLICATION OF PREDICTIVE ANALYTICS IN LIFE INSURANCE USING PRESCRIPTION DRUGS INFORMATION

■ Executive Summary

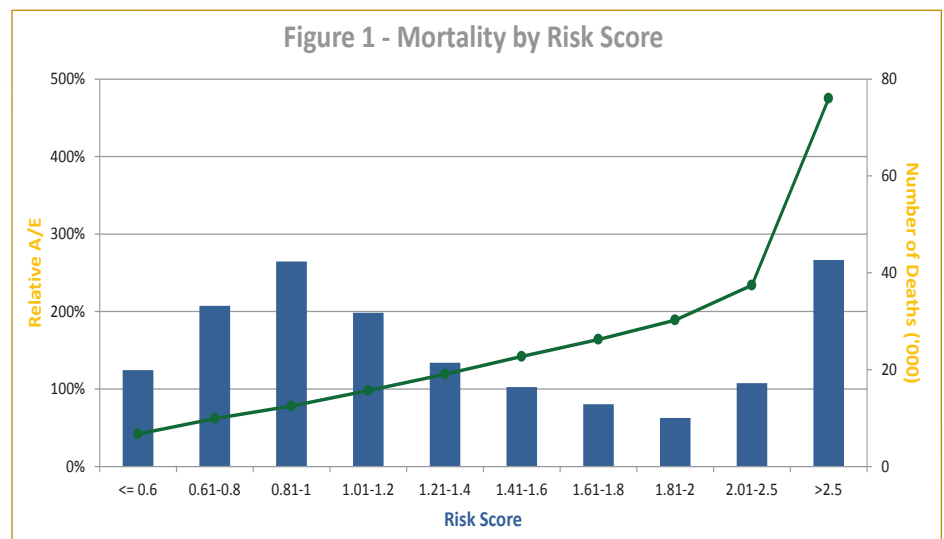
Optimum Re has reviewed Milliman's IntelliScript's Risk Score, which is a proprietary algorithm developed by Milliman using an individual's prescription drug history information to calculate a Risk Score as a predictor of future mortality. Based on more than 25 million Life, Health, DI, LTC, Final Expense and Medicare Supplement insurance applications, Optimum Re confirms Risk Score is a good predictor of future mortality: the observed mortality increases as the Risk Score increases.

Such algorithm may be used by insurance companies to replace traditional underwriting requirements by such predictive model. Optimum Re may assist insurance companies who wish to validate the predictability of Risk Score results on their own portfolio by performing a retroactive analysis and by guiding them in setting their mortality assumption.

■ Overall results

In order to analyze the predictability of the Risk Score, Optimum Re calculated actual to expected (A/E) ratios by various factors. The A/E ratio is the actual observed deaths compared the expected deaths based on an industry mortality table.

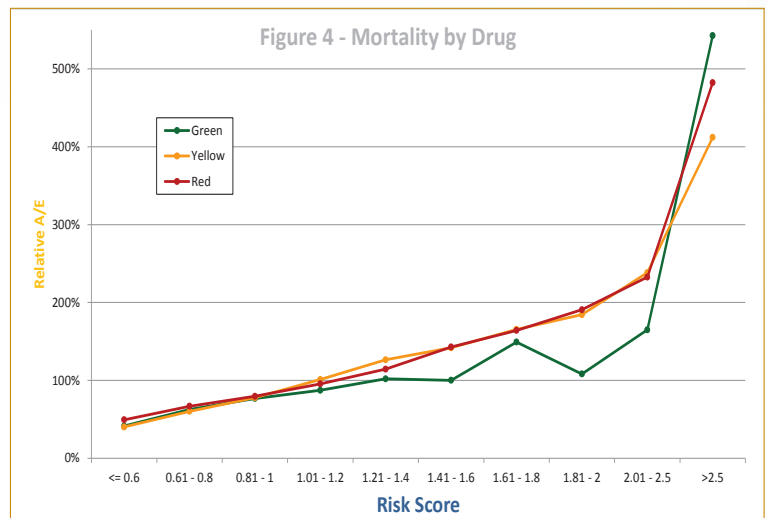
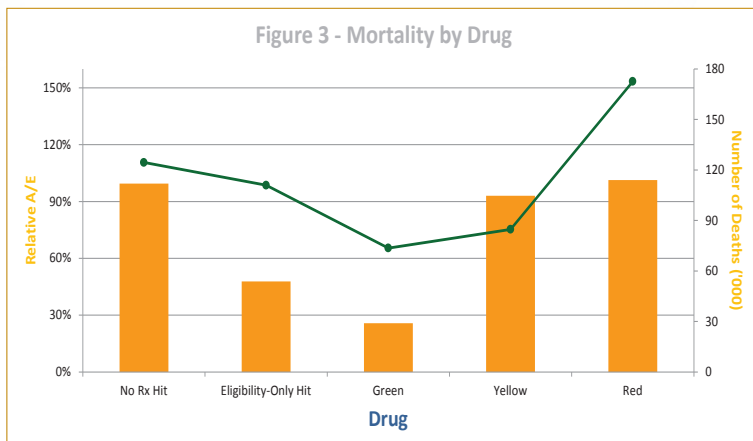
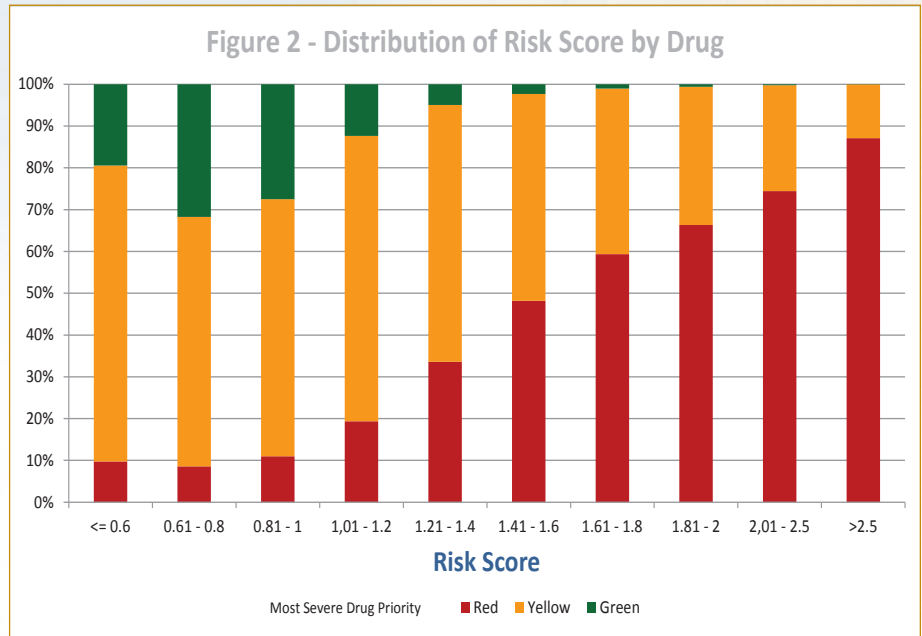
The overall results of Figure 1 show a direct correlation of the observed mortality with Risk Score: the higher the Risk Score, the higher the mortality (represented by the green line). The number of claims (represented by the bars) is sufficient to obtain full credibility. These results confirm the effectiveness of Milliman's Risk Score to predict future mortality.



■ Type of drugs

The IntelliScript algorithm uses the most severe drug intake by applicants and assigns a color corresponding to mortality risk. Green corresponds to a drug which is expected to yield a low mortality risk, Yellow a moderate risk and Red a high mortality risk. Figure 2 shows that the Most Severe Drug Priority is an important variable in determining the Risk Score. For Risk Scores above 2.0, which corresponds to applicants expected to generate the higher mortality risk, more than 75% of those applicants consume medications that are classified as Red Drugs. Not surprisingly, the highest proportion of Green Drugs is from the lower Risk Scores.

More than 50% of applicants with Risk Scores of 1.6 and less are classified as Yellow Drugs as can be seen in Figure 2. As shown in Figure 3, the mortality of the applicants using Red Drugs (153%) is substantially higher than the mortality of the Green Drugs (65%). The difference in mortality between the Green (70%) and Yellow (75%) drugs is not that large when ignoring the Risk Score. However, when analyzing Figure 4, the mortality of Yellow and Red Drugs (yellow and red lines) is very close which mean the algorithm is more complex than just finding the most severe drug priority and confirms the Risk Score is a better indicator of future mortality than the drug color.



The Green line diverges from the Red and Yellow lines as the Risk Score increases due to the limited number of claims from Green applicants with a Risk Score above 1.2. Applicants who were not found in any of the data sources are classified as “No Rx Hit” and those who were found with prescription drug eligibility but without any fills are classified as “Eligibility Only”.

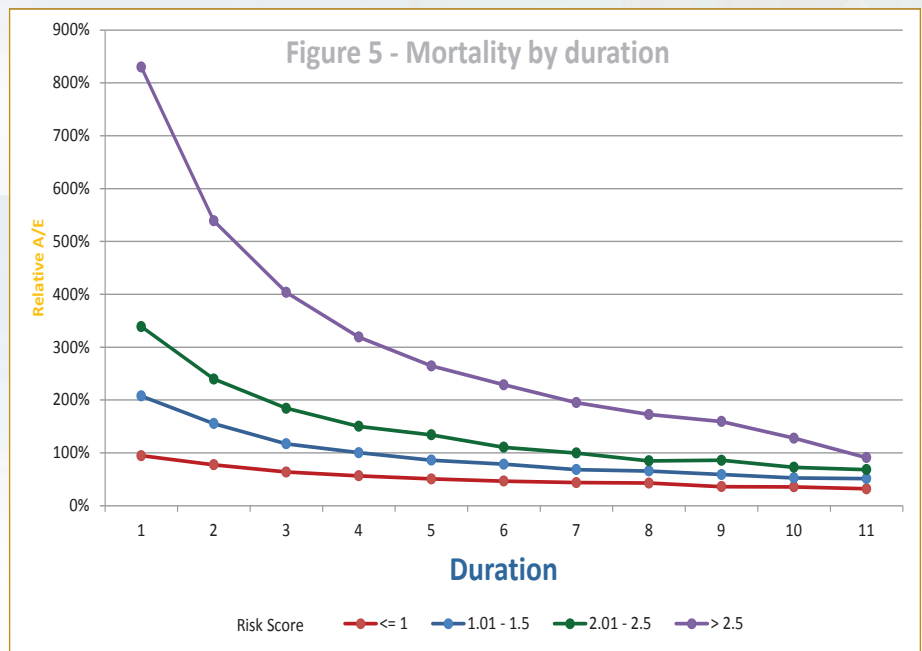
■ Duration

Figure 5 shows the mortality a number of years after the determination of the Risk Score. The mortality difference between risk groups is greatest during the first year and grades down to year 11, which seem to indicate that the predictability of the Risk Score wears-off over time. The number of deaths in duration 10 and 11 is limited and those results should be interpreted with care.

■ Smoking status and insurance amount

Unfortunately, the information available for analysis did not contain the smoking status nor the amount of insurance. If applicants who are smokers are less healthy and taking more prescription drugs than non-smokers, the algorithm might classify these smokers to the higher Risk Scores

and this could contribute to show a higher mortality differential of the best vs. the worst Risk Scores. Some additional analysis using the smoking status would be beneficial prior to implementing such algorithm and determining a mortality assumption.



■ Conclusion

Optimum Re confirms the algorithm developed by Milliman differentiates the mortality risk of insurance applicants using the prescription drugs information. Such algorithm could be used to speed-up the underwriting process while reducing the cost of traditional underwriting requirements. Optimum Re nonetheless

recommends performing some retroactive analysis on your company's own portfolio prior to implementing Milliman's Risk Score. Optimum Re may assist your company in these tasks and provide recommendations on the mortality assumption to use in pricing for your products.



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