

# LOW-SEVERITY PRESCRIPTION MEDICATION HISTORY GOOD FOR RISKS?

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Introduction  
In 2009, RGA and Milliman IntelliScript published

**Executive Summary** Individuals who have only low-severity medications in their prescription histories may not necessarily be those with the least mortality risk. These individuals tend to show lower utilization of prescription medications and are less likely to have recent prescription history information available. The mortality risk of those with less robust histories and no high-severity medications can be equal to or slightly higher than that of individuals taking moderate-severity medications. This is especially true for older individuals. There is also evidence that a lack of a prescription history, or a prescription history with a preponderance of low-severity medications, correlates with a lack of medical care. In other words, a person's mortality risk may not be fully captured by evaluating the medications they have been prescribed and have taken to treat their medical conditions.

RGA has a well-established database containing prescription medication histories and death information for millions of individuals. For this analysis, RGA focused on individuals ages 20-79 at the time of scoring. We set an evaluation date that split the time period DVVHVVG LQWR WZR VHFWRUV WKH 6 years up to the evaluation date; and the second, the mortality experience of the

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Within each age band, those with max scores of 1 were found to always have higher mortality than those with max scores of 2.

In the youngest age band (20-39), the mortality of those with max scores of 2 is lowest. However, this pattern changes for older age bands. The most prominent pattern is in the oldest age band, where the mortality of those with max scores of 1 and 2 is noticeably higher than those with max scores of 3 and 4. In other words, for the oldest age band, when the only medications in their histories are those with very low severity scores, mortality is higher than for peers who have max scores of 3 or 4. Those with max scores of 1 and 2 still exhibit relatively low mortality, but they may not be the very best risks in their age cohort. Since the medications all have low scores and are being prescribed primarily for low-risk and benign conditions, what could be driving the higher mortality?

One hypothesis is that the cohort with only low-severity medications in their histories might include individuals who do not receive consistent medical care. Indeed, those individuals with only low-severity medications in their histories correlate with those who have low scores on the "recency" metric. Their mortality would, therefore, be higher than that of those who have the same max scores but visit doctors regularly and are prescribed medications to treat and prevent medical conditions. A lack of regular medical care would be of greater concern for older-age individuals.

As a measure of recency, we explored this hypothesis by using the time between the last visit and the first prescription in each dataset member's prescription history. For the frequency metric, we measured the number of prescriptions per year.

The frequency metric served as a proxy for the robustness of the metric. The frequency metric was calculated as the number of prescriptions per year, divided by the number of years since the last visit. The frequency metric was calculated as the number of prescriptions per year, divided by the number of years since the last visit.

## Frequency

Figure 5 continues to focus on those with low max scores, assessing the mortality patterns for this group by three age bands.

As the chart shows, individuals with low max scores and fewer prescriptions in their histories experienced higher mortality than peers with more prescriptions. The better mortality experience for those with more

observed across all age bands, with a steeper slope at older ages. This observation also supports the lack of care hypothesis. Note members of the youngest age band (20-39) are older ages.

Frequency and max scores also correlate. Figure 6 shows exposure by

Those with lower max scores tend higher scores.

Recency and frequency in an Rx history do correlate, as expected. Those

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robust Rx history indicates higher mortality. In other words, both recency and frequency are important considerations.

**Prescription Histories, Risk and Predictive Models**  
As demonstrated above, the max scores approach to evaluating prescription histories – that is, using the highest severity drug in a patient’s history to determine mortality – may not necessarily capture the full range of prescription drug history complexities for individuals. Predictive models, which can simultaneously consider severity, recency and frequency, along with many other factors, may produce risk assessments that better match actual mortality experience.

During the past 4 years, RGA has developed the Rx Predictive Model Risk Score (RxPM Risk Score) tool, which utilizes a broad range of aspects of a prescription history, including the max score, to predict mortality risk. Scores produced by this model range from 1 to 100. Each score represents 1% of the underlying population. A score of 1 indicates the 1% of people with the lowest mortality risk, and a score of

Figure 8. A/E by RxPM Risk Score

100 demonstrates the 1% of people with the highest mortality risk. The RxPM Risk Score has been found to be highly predictive of mortality risk.

Figure 8 shows the mortality lift curve for the study dataset’s RxPM Risk Scores, with the curve for the scores of between 1 and 50 zoomed in on Figure 8a.

Mortality levels for those with RxPM Risk Scores of 96-100 are, as shown in Figure 8, more than 15 times higher than for those with RxPM Risk Scores of 1-5.

The proportion of those with RxPM Risk Scores of 1-50 were found to be approximately the same – about 50% – as the proportion with max scores of 1-4. However, for certain older-age bands, those with RxPM Risk Scores of 1-50 comprised a higher percentage of the total dataset than did those with max scores of 1-4.

The mortality lift curve shown in Figure 8a is clearly increasing monotonically by RxPM Risk Scores. This V X J J H V W V W K H 5 [ 3 0 5 L V N 6 F R U H F D Q E H for identifying those with low mortality risks.

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To further illustrate, let's look at two cases: both 70-year-old males with only low-severity medications in their prescription histories.

Case 1 represents a 70-year-old male with a benign history of allergies, constipation, a skin condition, and colds or other minor infections. He has a history of regular doctor visits for the benign conditions. His max score is 3 and RxPM Risk Score is 12, representing those with QGLFDWLQJ UHFHQW doctor visits.

Case 1.

| Medications                    | 2017  | 2018  | 2019  | 2020  |
|--------------------------------|-------|-------|-------|-------|
| Loratadine 10 MG tablet        |       |       |       | 1 0 0 |
| Methylprednisolone 4 MG dosepk |       |       |       | 1 0 0 |
| Mometasone furoate 0.1% cream  |       | 1 0 0 | 1 0 0 | 1 0 0 |
| Polyethylene glycol 3350 powd  | 1 0 0 |       |       | 1 0 0 |
| Amoxicillin 875 MG tablet      |       | 1 0 0 |       | 1 0 0 |

Case 2 represents a 70-year-old male who has had RQO\ RQH SUHVFULSWLRQ 1 0 0 GXULQJ WKH SDVW VHYHUDO \HDUV for what appears to have been a cold or other minor infection. Our study shows as the age of an individual LQFUHDVHV D ODFN RI SUHVFULSWLRQ 1 0 0 ZKLFK DSSHUV WR be a proxy for medical follow-up), adversely impacts mortality. The max score is 1 for this gentleman, but his RxPM Risk Score is 50 due to a combination of factors, which in this case included age and a light prescription history.

Case 2.

| Medications                | 2020  |
|----------------------------|-------|
| Amoxicillin 500 MG capsule | 1 0 0 |

Conclusions

When evaluating mortality risk using prescription histories, it is important to consider more than just the most severe medication taken. This is particularly true for those with QGLFDWLQJ UHFHQW

## About the Authors

Mike Cusumano is Vice President and Actuary in the Business Initiatives team within RGA's US Markets Division. He is responsible for actuarial analysis and development of data-driven and advanced analytics risk assessment solutions. As part of his 15 years at RGA, Mike previously held roles in experience studies and valuation. Mike is a Fellow of the Society of Actuaries (FSA) and received a BS in Actuarial Science from Maryville University in St. Louis, MO. He is currently serving on the leadership council of the SOA Product Development Section.

Preeti Dalawari, MD, is Medical Director for US Mortality Markets. Dr. Dalawari provides expert case con - VXOWLQJ DQG XQGHUZULWHU HGXFDWLRQ IRU 5\*\$ FOLHQWV \$ ERDUG FH and educator who joined the company in 2020. She continues to serve as an adjunct professor of surgery at the Saint Louis University (SLU) School of Medicine. Prior to RGA, Preeti had more than 14 years of clinical experience at SLU, including 9 years as Research Director within the division of emergency medicine. Most UHFHQWO\ VKH ZDV D VWDC SK\VLFLDQ DW WKH 9HWHUDQV \$GPLQLVWUD medical content consultant for Rosh Review. Preeti received a Bachelor of Science (BS) degree from Pennsylvania State University in a combined undergraduate and medical school degree program, and a Doctor of 0HGLFLQH IURP -HcHUVRQ 0HGLFDO &ROOHJH 6KH FRPSOHWHG D \HD Christiana Care Health System in Newark, DE, and received a Master of Science (MSPH) in public health and epidemiology from Saint Louis University School of Public Health and Social Justice. She is an experienced local and national public speaker and has published more than 25 articles.

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