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A VM-20 Mortality and Credibility Factor Observation

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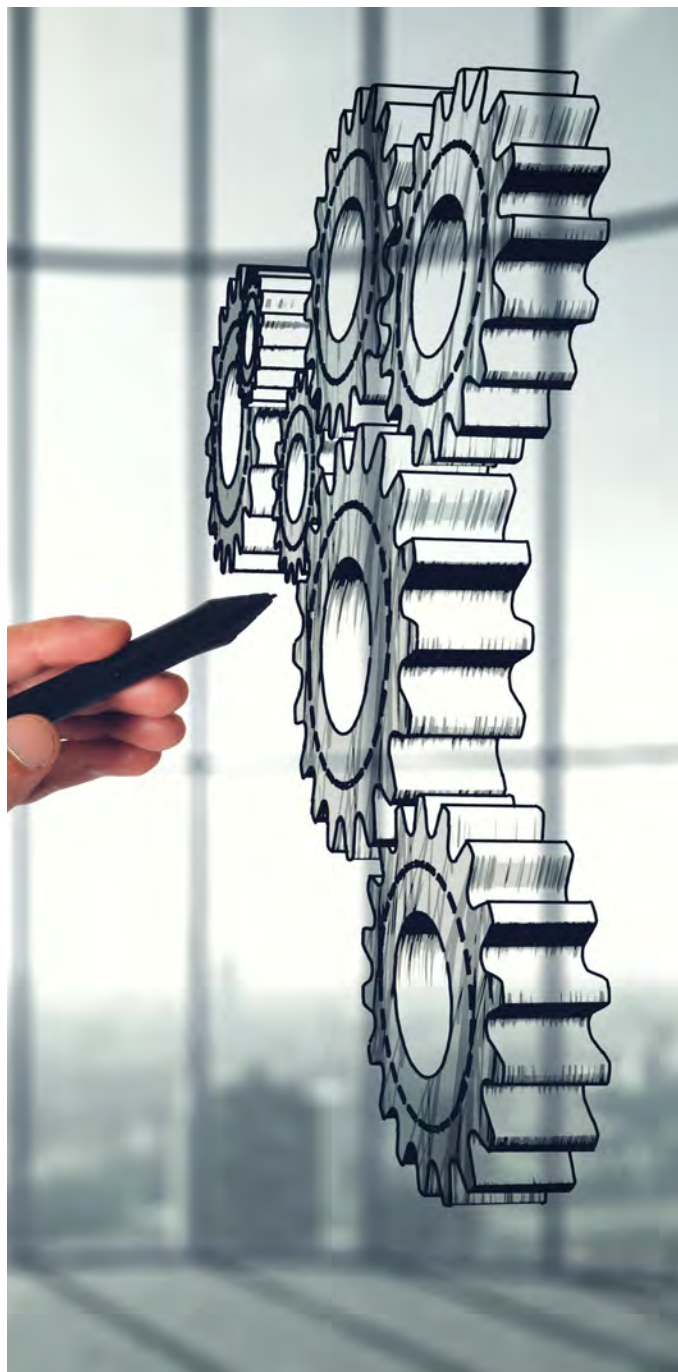
Many questions have been asked regarding VM-20¹ and reserves over the past decade. Will our company's reserves be lower or higher, and by how much? For small companies that are eligible to take the company-wide exemption from VM-20, the answer could affect the decision about if and when to implement VM-20. The answer, "It depends," isn't as clean or easy as a simple "lower/higher" and "by a lot."

Mortality is an obvious driver to answering the lower/higher/how much question. Hence, there is a second series of related questions: What is our mortality assumption? What is our credibility factor, and what does that mean for reserves? How much do reserves change with a higher credibility factor? At the lower end of the credibility spectrum, are reserves higher or lower than Triple X reserves? How much do reserves decrease with a little better credibility? This article presents graphical results² to provide insights into the last two questions.

The VM-20 mortality assumption splits the policy period into three periods:

1. Based on company tables plus margin
2. Graded linearly from 1–3 (company plus margin to industry plus margin)
3. Based on an industry table plus industry margin

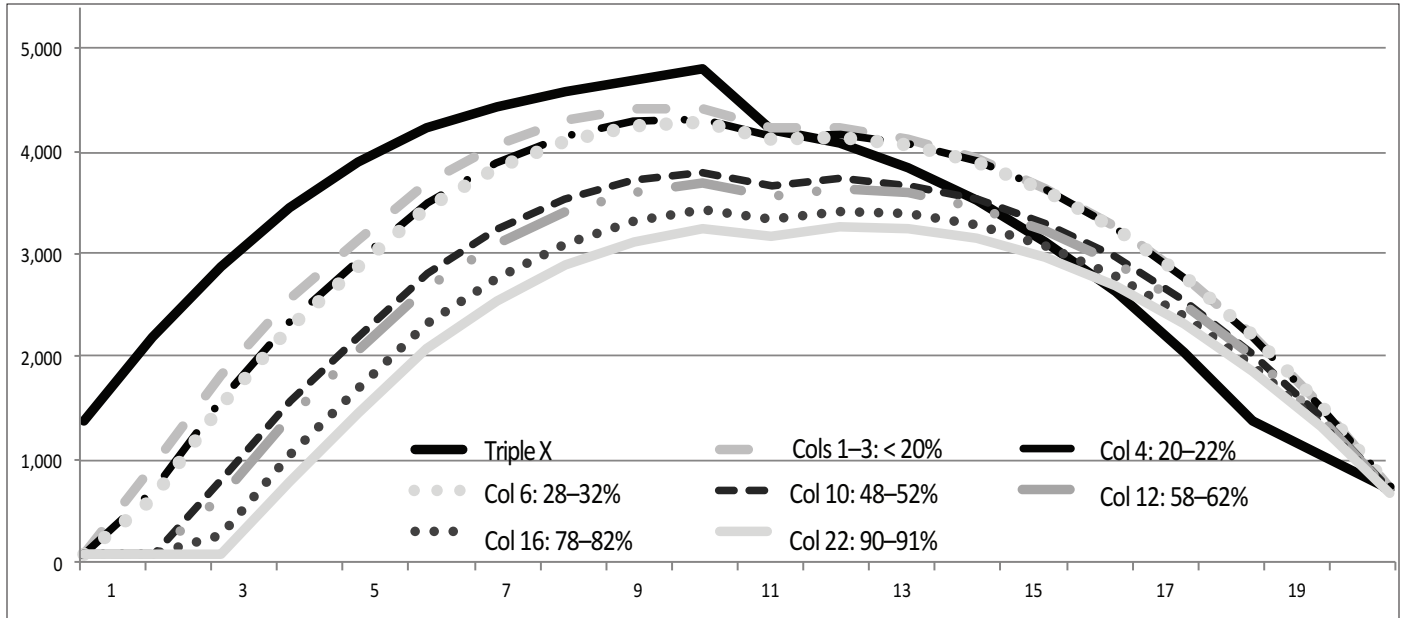
To determine a credibility factor, margins for the company tables are determined via one of two permissible credibility methods—Bühlmann and limited fluctuation. For both methods, the factor is used as a table lookup to determine a vector of margins: the column is based on the credibility factor, and the margins in rows vary by attained age. These margins are applied to company tables. Another dimension to credibility is how long the sufficient data period is; VM-20 defines this period as the last duration in which there were more than 50 claims. The sufficient data period, along with the credibility factor, is used to determine the length, start and end of each of the three periods. However, if the credibility factor is less than 20 percent, the



assumption is based strictly on the industry table (i.e., Periods 1 and 2 are zero years). The details of the mortality assumption process are beyond the intent and scope of this article.

Figures 1–4 present Triple X vs. deterministic reserve results for a 10/20 year term cohort using Bühlmann credibility factors for seven of the VM-20 margin table's 24 columns—those corresponding to the columns for 18–22 percent, 28–32 percent, 48–52 percent, 58–62 percent, 78–82 percent and 90–91

Figure 1
Projected Deterministic Reserves (DR) + Deferred Premium Asset (DPA) by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

Table 1
Age 0–45 Margins Applied to Company Table for the Seven Trials

<20%*	18–22%	28–32%	48–52%	58–62%	78–82%	90–91%
20.4%*	20.4%	19.3%	16.3%	14.6%	10.3%	7.3%

* The margin applied to the industry table.

percent. The margin decreases as one moves across the table from left to right. To avoid the possible confusion that the results are consecutive columns (they are not), I use the word *trial* as a label rather than *column*. The margins at ages 0 to 45 for these trials are shown in Table 1.

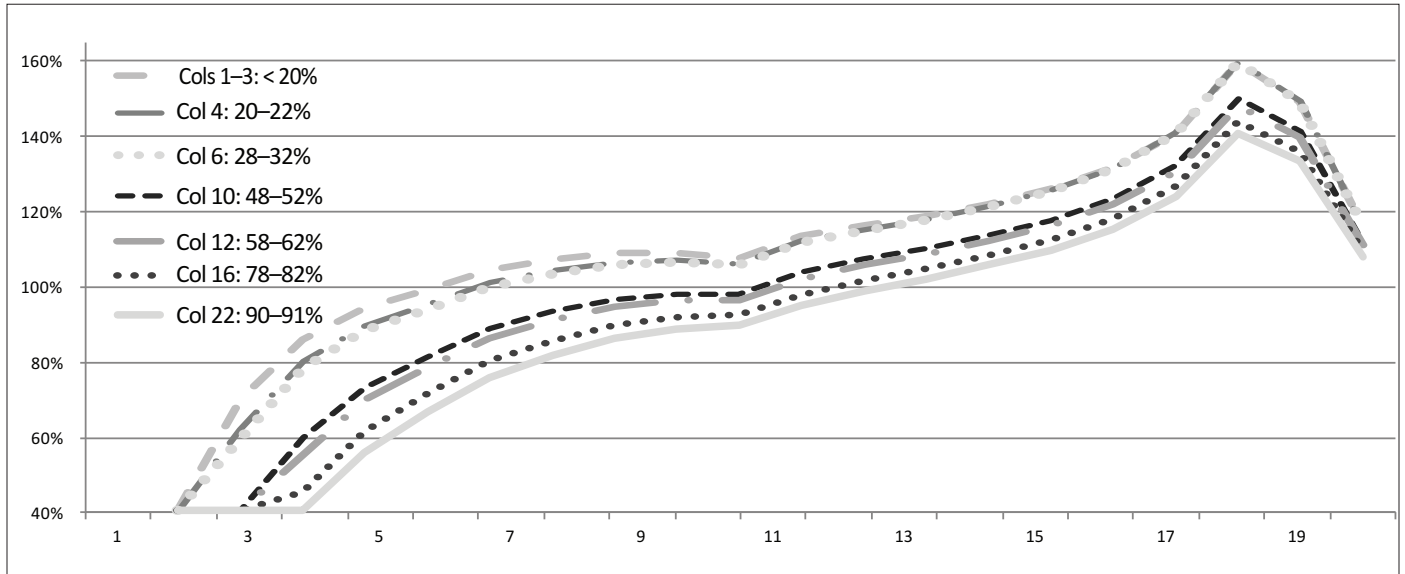
The 10/20 year term cohort consists of one year of issues—40 percent 10 year, 60 percent 20 year—using LIMRA sales mix data. Reserves are on a direct basis. Triple X reserves used an X factor of 60 percent for all policies.

Deterministic reserves depend on a myriad of other assumptions and modeling methods. For our representative block, DR + DPA is larger than Triple X after year 11 for trials using margins from Columns 1–6. DR + DPA starts out much lower than Triple X, but the difference grows smaller over 10 years. Both the projection and DR reflect a shock lapse occurring at years 10 and 20 (100 percent lapsation at the end of the level periods). The Triple X projection “releases more reserve” on the

10-year block due to the projection’s shock lapse rate. As far as years 1–10, lower premiums or different assumptions (such as higher maintenance expenses and surrender rates) could reverse the Triple X to DR + DPA relationship before year 10.

Without knowledge of all the assumptions, one cannot and should not read too much “this is always the case” into the values. Specific contexts matter. However, we are interested in change—namely, change due to a shift in the credibility factor. Changing other assumptions would simply shift all the non-Triple X results by nearly the same amount. In Figure 1, the trials alternate between dark and light and use different dash-dot patterns. Since VM-20 minimum reserves make a comparison of the deterministic reserve plus the deferred premium asset to the net premium reserve (NPR), the analysis considers DR + DPA. As expected, DR + DPA decreases across all policy years as the credibility factor increases, meaning a column farther to the right in the VM-20 table is used, resulting in lower margins for the company table. Visually we see

Figure 2
Ratio of Trial N's DR + DPA to Triple X by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

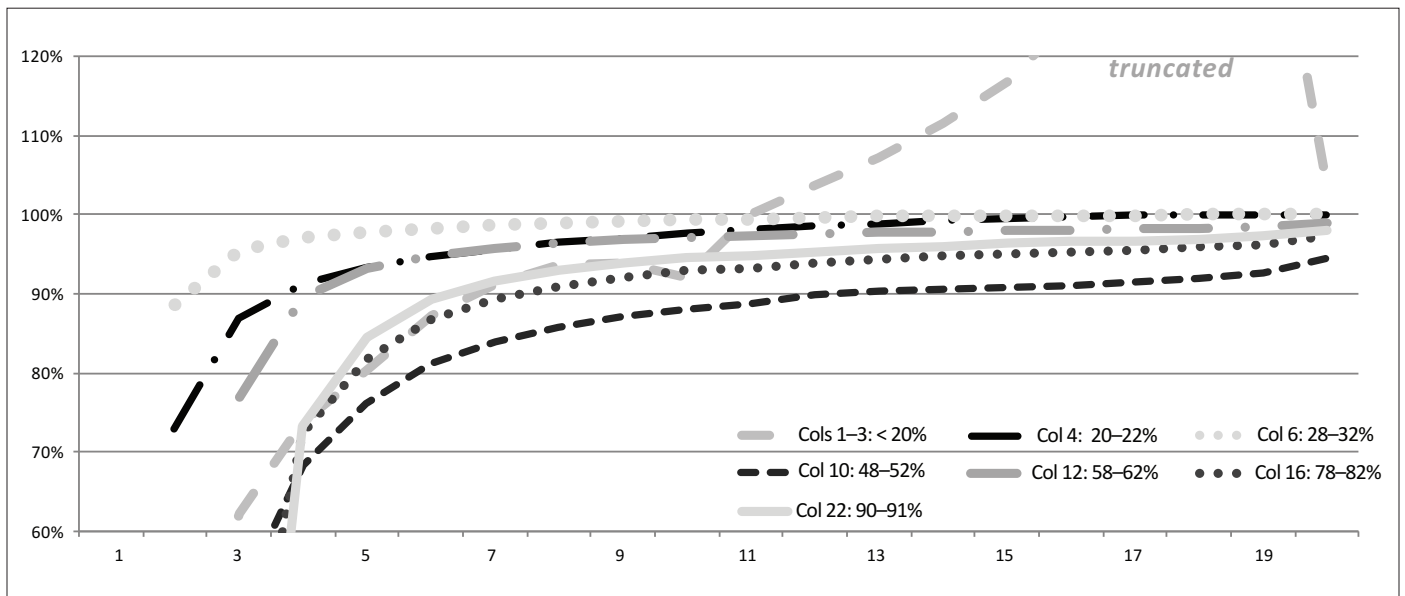
significant reduction in reserves from Trial 3 (Col 6) to Trial 4 (Col 10) and from Trial 6 (Col 12) to Trial 7 (Col 16).

years are not shown because DR + DPA is zero or small, resulting in undefined and/or very large ratios.

Figure 2, by taking the ratio, allows us to see each trial's DR + DPA as a percentage of Triple X. Some values for early policy

Figure 3 compares the percentage change from one trial to the next. The first ratio—Trial 2 (20 percent) to Trial 1 (Triple

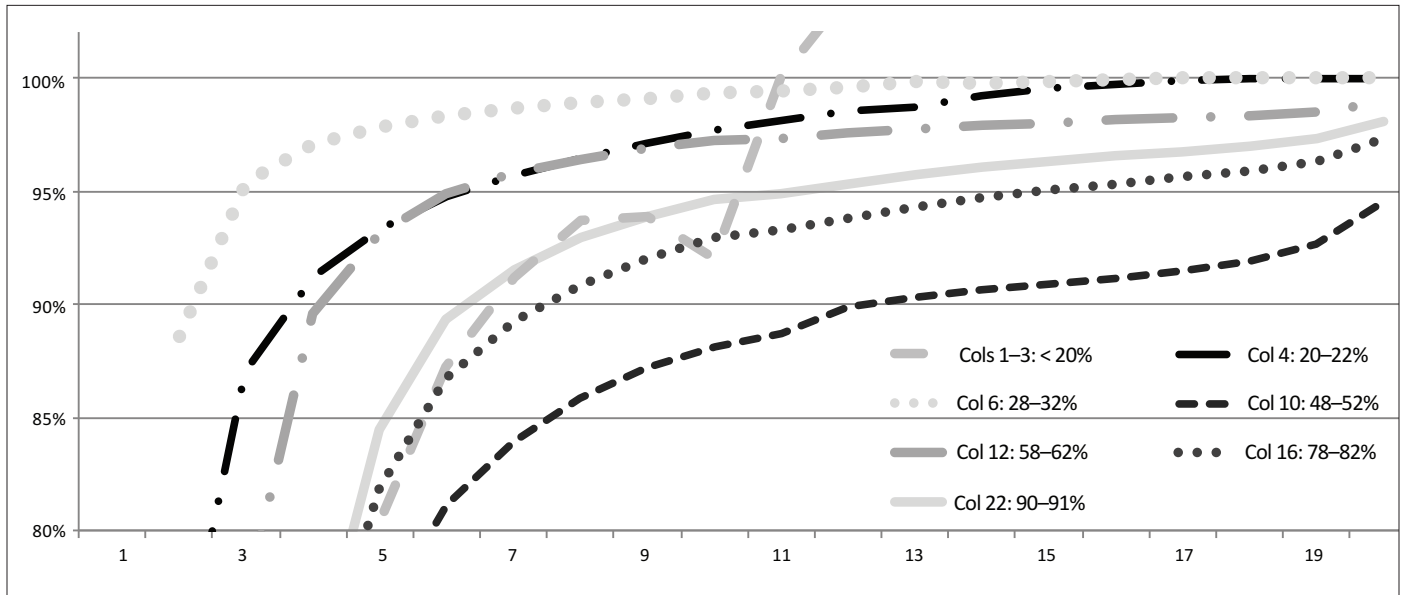
Figure 3
Ratio of N + First Trial's to Nth Trial's DR + DPA by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

Figure 4

Ratio of N + First Trial's to Nth Trial's DR + DPA—A Closer View by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

X)—looks different than the others because the comparison is between different reserve bases. The graph is truncated at 120 percent because the ratio gets large in years 16–18. The ratio of Trial 4 to Trial 3 (Col 6 to Col 4) shows that reserves decrease by 0–3 percent. The ratio of Trial 3 to Trial 2 (Col 4 to <20 percent) and the ratio of Trial 6 to Trial 5 (Col 12 to Col 10) show that the reserve reduction is 10–5 percent for years 3–6 and 5–0 percent thereafter. The other ratios show significant reductions between trials across nearly all policy years.

Figure 4 takes a closer look at Figure 3 by limiting the y-axis to 80–100 percent.

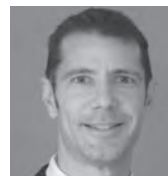
COMMENTS

Without turning this article into a monograph and a proliferation of graphs, results using the limited fluctuation method are similar, as are blocks with slightly different assumptions. As far as whether low credibility can result in reserves higher than Triple X reserves—yes, it is possible. Other factors such as lower premiums, higher expenses and so on can move the needle sufficiently to alter the Triple X to DR + DPA relationship. But the “answer,” as stated in the introduction, is “It depends.”

The general observation is that, as suspected, mortality credibility factors do materially impact deterministic reserves. Do not read too much into the precision of the values or ratios in Figures 1–4. But even imprecisely, one can see that higher credibility can lead

to lower deterministic reserves, which may result in competitive advantages relative to companies with lower credibility.

VM-20 permits companies to exercise actuarial judgment in determining the assumption and the relevant data; VM-20 permits internal and external sources of data such as reinsurers, LIMRA and MIB. Widening the quantity and quality of underlying data leads to higher credibility. However, criteria entail sharing similar characteristics, and VM-20 defines neither *similar* nor *characteristics*. Companies and actuaries alike will be looking for solutions to the challenges in developing and setting mortality assumptions. One of the challenges materially impacting deterministic reserves is credibility. ■



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ENDNOTES

- 1 National Association of Insurance Commissioners, *Valuation Manual*, April 2016. http://www.naic.org/documents/cmte_a_latf_related_val_adapted_160829_with_changes.pdf.
- 2 The PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.