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Developing Group Health Credibility Factors through Stochastic Modeling

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In the current group health marketplace, credibility factors are generally the result of years of marketing pressure to increase the factors in order to quote more competitive rates for groups with lower-than-expected claims experience. We have seen the minimum size of groups considered “fully credible” diminish over the decades. Using higher credibility factors than can be actuarially justified may not be an optimum strategy to maximize either market share or profitability.

A group’s annual claims are highly random for all but the largest cases. By utilizing high credibility factors and quoting low rates on groups with low current claims, insurers take a great risk if the claims revert to their normal levels. Conversely, they price themselves out of the market for groups with high current claims.

Insurers do not make money by writing low claims groups; they make money by quoting appropriate rates for all groups. They can do this by using actuarially determined credibility factors.

In my 42 years of experience in group actuarial practice, I have long been interested in the concept of credibility. I have attended many credibility sessions and read many papers but have not really been satisfied with any of the approaches.

I propose we drop the attempts to develop a purely mathematical formula for group health insurance credibility and instead see what can be obtained through the use of stochastic models creating simulated claim data.

We can create member-based claim distribution tables if we have sufficient claim data. If not, we can use leased data from a consulting firm.

With a member claim distribution table based on actual group health claims experience, we can develop a stochastic model to generate annual claims for each member of any size group we want. For a particular hypothetical group of any size, we can then simulate any number of policy years’

claims experience. This is, of course, not possible with actual claims.

What is Group Health Credibility?

We talk about actuarial science, but science implies precise definitions of terms. What is our definition for group health credibility? How do we define it mathematically?

I propose we define group health credibility as the probability that the actual annual claims of a particular group will fall within ± 5 percent of the expected value. Using this definition, we can measure the credibility of a group’s experience directly from the simulated annual aggregate claims developed by our model for that group. If we run n policy years of claims for the group, then the credibility is equal to the total number of years in which the annual claims were ± 5 percent of the expected amount divided by n .

To properly develop credibility factors, we need to take into account the following three parameters that impact the credibility of group health claims experience:

- Pooling levels
- Member claim correlation
- Member turnover

Pooling Levels

Many current credibility factor tables make no provision for the pooling mechanism group carriers employ to stabilize claims experience for new business quotes and existing policy renewals. Intuitively, we know that lower pooling levels produce more stable claims experience from year to year and therefore higher credibility. By excluding claims above the pooling level and adding an appropriate pooling charge (the expected amount of the claims exceeding the pooling level) to each members’ claims, we can incorporate the effects of pooling into the simulated claims provided by the model. We can then directly measure their effects on credibility.

Chart 1 shows the effects of different pooling levels on credibility based on the output of the stochastic model for groups of 50 to 1,050 members.

The output of the model confirms that the lower the pooling level, the greater the credibility of the group's claim experience. The experience of a group with 1,050 members has a credibility of 30 percent with no pooling, which increases to 58 percent by pooling at a level of \$60,000.

Member Claim Correlation

Many mathematical approaches to credibility theory utilize the simplifying assumption that a member's claims from year to year are independent. Without that, the math becomes too complex. To develop more accurate credibility factors, we need to account for the fact that a particular member's claims are not independent from one year to another. People who are healthy tend to remain healthy, while people with chronic health issues will continue to have them.

By comparing each member's claims from one year to the next using actual claim data, we can develop a cumulative probability claim distribution by claim ranges. Within the credibility model, we can use this distribution to develop a current-year claim amount for each existing member based on their prior year's claim amount.

Chart 2 shows a small segment of the complete cumulative probability distribution for a given range of claim values. It can be seen that if a member has \$0 claims in the prior year, the probability of their having \$0 claims in the current year is roughly 54 percent. If the member had \$799.25 in claims in the prior year, their probability of having \$0 claims in the current year is only about 6 percent. The \$799.25 and other claim amounts shown are actually the lower boundaries of a range of claims. This distribution was based on the actual experience of a major carrier's large group and Administrative Services Only (ASO) claim data for members that were in force over a two-year period.

CHART 1

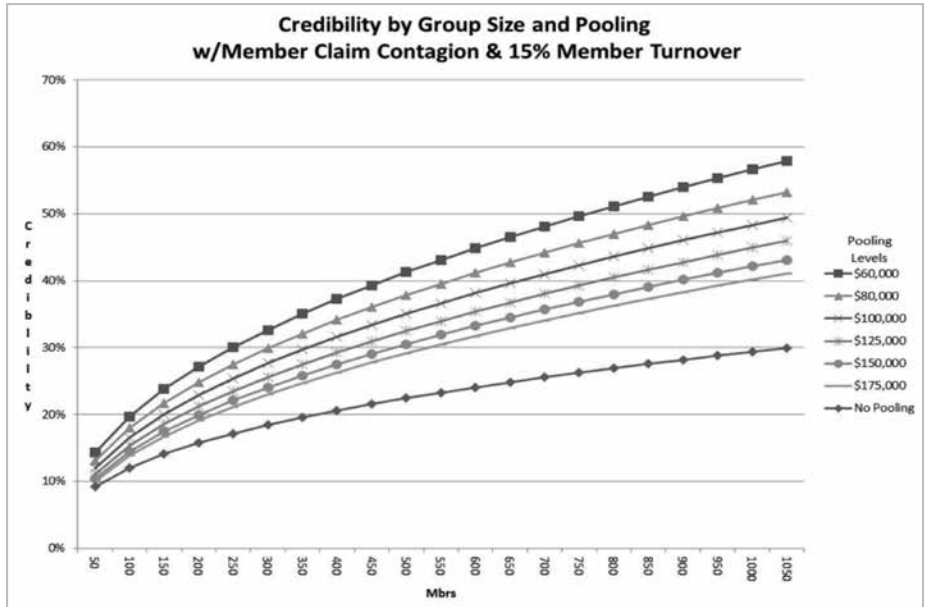
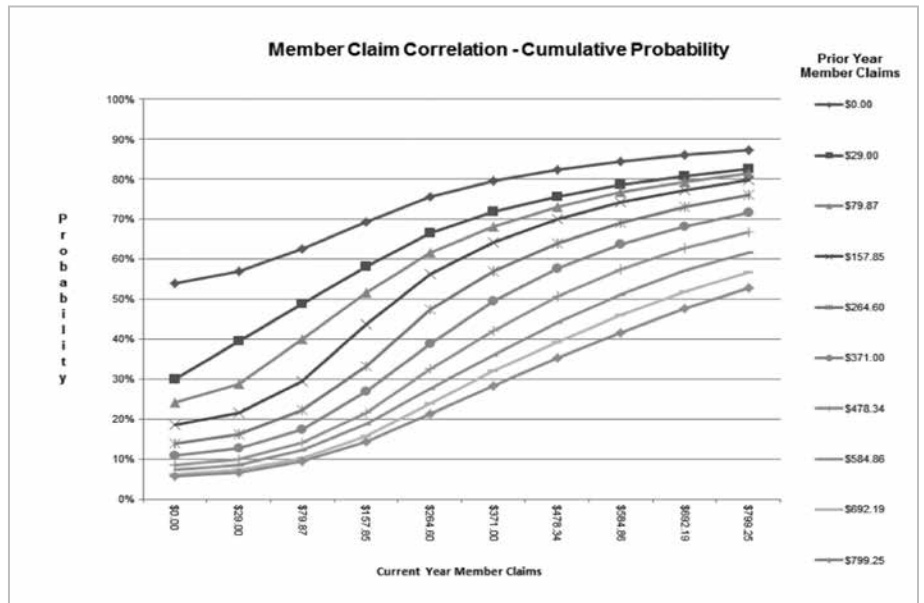


CHART 2



Member Turnover

This parameter somewhat offsets the member claim contagion since if a member is no longer with the group, it doesn't matter what their claims were last year. Conversely, if they are new to the group, their claims are not included in the prior year's claim experience.

I am defining member turnover here as one minus the ratio of the total member months of a group for a 12-month period to the count of the unique members in force during that period multiplied by 12. This definition takes into account the member months of exposure lost by those leaving the group during the policy year as well as those who enter the group after the effective date.

The weighted mean member turnover of a typical block of large group and ASO business is roughly 15 percent.

Chart 3 shows the effect of member turnover on credibility. The effect is more noticeable in the larger groups because they are more credible to begin with.

Summary

I have demonstrated that developing credibility factors for group health insurance can be accomplished empirically through the use of stochastic models with appropriate parameters and fairly readily obtainable data, without the need for unrealistic assumptions.

Stochastic modeling is a powerful tool that can be used to solve many problems a pricing actuary may come across. I hope this article will stimulate interest in this topic as well as my new approach to credibility theory. ■

CHART 3

