ACTUARIAL RESEARCH CLEARING HOUSE
1993 VOL. 3

A METHOD FOR ANALYZING SPECIFIC STOP-LOSS MEDICAL INSURANCE CLAIMS

Submitted for the Sixth Annual Practioners' Award
Actuarial Education and Research Fund

by
Timothy M. Ross, ASA, MAAA
Deloitte & Touche
Minneapolis, Minnesota

A Method for Analyzing Specific Stop-Loss Medical Insurance Claims

Statement of the Problem

A specific stop-loss medical insurance underwriter will write policies for self-funded medical insurance plans to protect against the risk of loss from high claims on a single individual. Very often, these plans are administered by a differenct entity than the stop-loss underwriter. As a result, the stop-loss underwriter will receive information only with respect to claims that are near to or in excess of the specific stop-loss deductible. Thus, the first part of the problem is that the stop-loss carrier has a limited amount of information available.

The second part of the problem is that the stop-loss carrier will write policies at a variety of deductibles. Smaller groups will tend to buy lower deductibles, while larger groups will tend to buy higher deductibles. A typical book of business will include a large number of small groups with lower deductibles, and a smaller number of large groups with higher deductibles. At the same time, the frequency of claims at the lower deductibles is higher than the frequency from the higher deductibles. The frequency of high medical claims can be quite low, i.e. as low as 1 claim in 10,000 lives or lower, adversely affecting the credibility of experience on high deductible policies.

An actuary wishing to price specific stop-loss insurance (or most other types of insurance) has two options. The first option is to rely on statistical information derived from a large database. This approach is often used for low frequency coverages, where credible experience is difficult to obtain. However, this approach leaves open the question of how appropriate the experience from the larger database is to the book of business being priced. The second option available to the pricing actuary is to use the experience from the book of business being priced. This approach necessarily includes those characteristics unique to the book of business. For this reason, this approach is preferred where the available experience is credible.

This paper will present a method for analyzing the experience of a stop-loss underwriter to develop a claim continuance table. This method is designed to deal with the limitations presented (limited information from a mixture of policies) so as to get the most out of the available information. To the extent this approach is succesful, the credibility of the experience analysis will be maximized, thus minimizing the reliance on external data.

Statistical Basis for the Method

A claim continuance table gives the distribution of claims sizes from small to large. This table can be expressed in frequencies of claimants reaching a certain dollar amount of claims, or in terms of the proportion of claim dollars in excess of a given deductible amount. This paper will discuss the frequency of claimants, although the method can be readily applied to the proportion of claim dollars.

The method relies on the formula for conditional probabilities:

$$\mathbf{Pr[B] = Pr[B|A]\ Pr[A]}$$

This process can be extended to a series of conditional probabilities, as follows:

$$\mathbf{Pr[Z] = Pr[Z|Y]\ Pr[Y|X] \ldots Pr[B|A]\ Pr[A]}$$

Actuaries are familiar with this process in developing claim reserve factors from claim lag studies. The methodology presented here uses a similar process in evaluating claims to develop a claim continuance table.

The Method

The method begins by specifying the points to be evaluated on the claim continuance table. For example, the points selected might be every \$10,000 from \$10,000 to \$100,000, every \$25,000 to \$200,000, and every \$50,000 beyond. Two consecutive points are selected from the continuance table, denoted **A** and **B**, where **A** < **B**, (e.g. **A** = \$10,000 and **B** = \$20,000). All policies are identified where the specific stop-loss deductible is less than or equal to **A**. Then, let:

> N(**A**, ded < **A**) = the number of claimants with claims in excess of **A** from policies with deductible less than **A**, and
>
> N(**B**, ded < **A**) = the number of claimants with claims in excess of **B** from policies with deductibles less than **A**.

Then we note that:

$$E\{ N(B, \text{ded} < A) / N(A, \text{ded} < A) \} = \Pr[B|A].$$

That is, the ratio of the number of claimants gives an approximation to the probability that a claimant with claims in excess of **A** will also have claims in excess of **B**. This process is repeated for points B and C on the continuance table, and so on for the various points on the table. In doing so, we note that N(B, ded < A) is not necessarily equal to N(B, ded < B), as the subset of policies with deductibles less than A may be smaller than the subset of policies with deductibles less than B. Upon completion of this process, a series of estimates has been developed for the conditional probabilities:

$$\begin{gathered} \Pr[B|A] \\ \Pr[C|B] \\ \Pr[D|C] \\ \cdot \\ \cdot \\ \cdot \\ \Pr[Z|Y] \end{gathered}$$

The next step in the method is to multiply the conditional probabilities, which yields a continuance table conditional on the probability of a claim reaching the lowest deductible used in the analysis. In other words, the analysis has determined the shape of the continuance table for claims in excess of A, and it remains to determine the value of **Pr**[A]. This value can be determined by evaluating the frequency of claimants at deductibles of **A**, **B**, C, etc. It should be noted that the value of Pr[A] will determine the pricing for the entire continuance table; it therefore is advisable to select a value that replicates the experience of the entire book of business. This is especially so with respect to the claim dollar approach, as opposed to the claim frequency approach.

This method extends to the claim dollar approach by considering the dollar value of all claims in excess of the deductible **A**. Given these claimants, determine also the dollar value for claims in excess of **B**. The ratio of these two dollar values provides an approximation to the proportion of claims in excess of **B**, given the claims in excess of **A**. A similar "chaining" of probabilities develops a continuance table conditional on the value of claims in excess of the lowest deductible in the analysis.

The purpose of the method outlined here has been to extract meaningful information from the available policy experience. Further steps in pricing stop-loss insurance will include adjustments for trend and loadings for expenses, risk and profit. In addition, adjustments for credibility may be required for very high deductibles, due to the extremely low frequencies involved.

Characteristics of the Method

The method outlined in this paper allows for the development of a credible claim continuance table from a block of specific stop-loss policies. Such a block may include a large number of policies with low deductibles (e.g. below \$25,000) and covering relatively few lives (e.g. less than 200 employee lives in each group.) In the middle range, there may be smaller number of policies covering a range of higher deductibles (e.g. \$25,000 to \$100,000) and covering a larger number of lives (e.g. 500 to 2000 employee lives in each group.) Finally, there may be a few policies with very high deductibles and covering the largest groups in the block of business.

To continue, such a block of business will have the least exposure base with respect to claims at the lower claim levels, and the greatest exposure base with respect to the higher claim levels. At the same time, the frequencies at the lower claim levels are higher, and the frequencies at the higher claim levels are lower. The net result is that the patterns of exposure and claim frequency partially offset one another. For example, while the claim frequencies may vary by a factor of 30 to 1 from low deductible to high deductible, the observed number of claimants may vary by less than 10 to 1. The net result is an improvement in the credibility of the continuance table at the higher deductibles than could be achieved by looking at high deductible policies only.

This method also develops the conditional probabilities as part of process. Since these probabilities may follow a regular pattern, e.g. $Pr[B|A] > Pr[C|B] > Pr[D|C]$ etc., it may be possible to use smoothing and graduation techniques to improve the final continuance table. In a similar fashion, credibility considerations at the higher deductibles may suggest blending in the conditional probabilities from an external table, rather than the absolute probabilities.

Finally, this method attempts to make use of the available data to develop a credible continuance table. As noted, credible experience is generally preferable to statistics derived from a larger database that may not reflect the characteristics of the book of business in question. The question is whether it is reasonable to expect credible experience from the available data. To answer this question, please note that, depending on the distribution of specific stop-loss deductibles, each dollar of incurred stop-loss claims may reflect 15 to 25 dollars of incurred claims in the underlying pool of self-funded employer plans. Thus, a block of stop-loss policies generating $50 milion in claims may reflect over $500 million in underlying claims and over 500,000 covered employee and dependent lives. This suggests that it is reasonable to look for credible experience in the available data.

Criticism of the Method

Two key criticisms of this method emerge. The first is the practical problem of determing the level of the continuance table. As noted above, the value selected for the unconditional probability at the lowest deductible used in the analysis will affect the pricing at all deductible levels. This is an issue that must be carefully addressed in addition to developing the overall shape of the continuance table.

The second issue is that of data homogeneity. While the method is homogeneous with respect to the book of business overall, the book of business itself may not be homogeneous. In particular, the smaller groups selecting lower deductibles may have different risk characteristics from the larger groups selecting the higher deductibles. Differences in the underlying morbidity and claim experience will affect the stop-loss claim experience; in turn, this will affect the conditional probabilities and the model results. Therefore, data homogeneity must be considered in applying this method.