Since the early 1990s, the life insurance industry has embraced the concept of preferred underwriting classification. Insureds with favorable health factors such as low cholesterol, low blood pressure, good build and no tobacco usage pay lower premiums, while those at the other end of the health spectrum pay higher rates. In theory, assigning insureds into a preferred underwriting class should result in a group of individuals with similar risk profiles. In reality, however, this process is far from perfect. Rather than creating a clean demarcation of who is preferred and who is not, the insurance industry’s typical classification scheme produces a very fuzzy boundary that misplaces many insureds into the wrong underwriting class.

A Model for Preferred Life Mortality

To illustrate the true nature of preferred underwriting classification, I applied a Cox Proportional Hazards mortality model to a database of approximately 220,600 recently underwritten male nontobacco lives. Each database record contained indicators for age, gender and smoking status, as well as values for blood pressure, total cholesterol and HDL ratio. Details of the Cox model are beyond the scope of this article. However, the model is frequently applied in clinical research studies to analyze relative mortality among groups having different medical conditions. My model was tested and validated using data from SCOR’s proprietary mortality experience database.

I created a simple three class underwriting structure for male nontobacco users. Each life in the database is assigned to a class according to the criteria shown in the table below:

<table>
<thead>
<tr>
<th>Super Preferred</th>
<th>Preferred</th>
<th>Residual Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index ≤ 26</td>
<td>Body Mass Index ≤ 29</td>
<td>Body Mass Index ≤ 37</td>
</tr>
<tr>
<td>Total Cholesterol ≤ 240</td>
<td>Total Cholesterol ≤ 280</td>
<td>Total Cholesterol ≤ 320</td>
</tr>
<tr>
<td>HDL Ratio ≤ 5.0</td>
<td>HDL Ratio ≤ 6.5</td>
<td>HDL Ratio ≤ 9.9</td>
</tr>
<tr>
<td>Blood Pressure ≤ 135/85</td>
<td>Blood Pressure ≤ 140/90</td>
<td>Blood Pressure ≤ 160/95</td>
</tr>
</tbody>
</table>

Similar to most of today’s preferred classification methodologies, failure to meet any single criterion knocks a life out of that class. I have ignored secondary factors such as motor vehicle record, family history, personal history...
Mortality for a large and diverse population shows a normal distribution, and avocation/vocation for the sake of simplicity. Lives not qualifying for Super Preferred or Preferred are placed into a Residual Standard class.

Distribution of Relative Mortality

The model’s predicted mortality for each life in the database is represented as a relative percentage, with 100 percent being the average mortality for all lives combined. Figure 1 shows the distribution of these percentages. Values range from around 45 percent for lives with the lowest mortality to well over 175 percent for lives with the highest mortality. It is encouraging to see that mortality is approximately normally distributed about the mean value of 100 percent. For those familiar with the pattern of mortality in a diverse population, this is not an entirely unexpected result.

The Reality of Preferred Classification

Since it is known which lives are Super Preferred, Preferred and Residual Standard, it is easy to plot the distribution of mortality in each underwriting class separately. As shown in Figure 2, each distribution approximates a normal curve, just like the distribution for all lives combined. Notice how much overlap exists in mortality among the three classes.

Compare the theoretically ideal distribution of mortality by class shown in Figure 3 with the model results in Figure 4. This shows in a very dramatic fashion the reality of preferred underwriting classification.

While my illustrative underwriting system is a little simplistic, the knock-out methodology it represents is a good proxy for how most life insurance companies categorize preferred lives. Figure 4 shows that the use of a limited number of cardiovascular mortality markers is insufficient to segregate lives in anything but the crudest manner. To be fair, the majority of today’s knock-out classification methods vary criteria values by age groups and include motor vehicle and personal/family history indicators. I am also seeing more companies use debit/credit classification systems that try to fairly balance positive and negative risk factors. These enhancements tend to lessen the mortality overlaps shown in Figure 4 but certainly not eliminate them entirely.

From a pricing perspective, the average mortalities for the Super Preferred, Preferred and Residual Standard classes, based on the theoretical distributions in Figure 3, are not too far from the averages using the actual distributions from Figure 4. Super Preferred actual mortality is about five percent higher than theoretical. Preferred actual is nearly equal to theoretical. Residual actual is less than 10 percent lower than theoretical. Realize, however, that the theoretical average mortalities would have been used as an expectation only in the absence of any

Each subset of a normal distribution (Super Preferred, Preferred and Standard classes here) likewise shows a normal distribution.
other knowledge. Company and industry experience
studies reflect actual distributions and are the sources of
mortality assumptions for current premium calculations.

Conclusion

So how has the life insurance industry gotten away
with (so to speak) the use of such a crude classification
technique? Well, everyone is pretty much doing the
same thing. Therefore, anti-selection among companies
competing for the same lives is minimized. Any change
in the industry’s classification scheme could produce a
dramatic shift in sales distributions as well as generate
market confusion on the part of agents and consumers.
So, no company wants to be the first to make a move –
the status quo remains. ∞

In reality, Super Preferred mortality is about five percent worse than the
theoretical ideal. Preferred mortality is about even with the ideal and residual
Standard lives are 10 percent better than ideal.