RECORD OF SOCIETY OF ACTUARIES
1983 VOL. 9 NO. 2

JOINT MEETING OF THE REINSURANCE SECTION AND THE INDIVIDUAL LIFE INSURANCE AND ANNUITY PRODUCT DEVELOPMENT SECTION

NEW TERM PRODUCTS FOR THE LARGE POLICY MARKET

1. Reversion Rates and Mortality on Non-Reverted Lives Implied by the Mathematical Law of Select Mortality: Irwin T. Vanderhoof.

2. Mortality Experience Versus Mortality Tables: Gottfried Berger*

3. Design and Premium Rate Implications Related to Select and Ultimate Term Insurance Products: Allen D. Booth

4. Panel Discussion: The Developing Experience Under These Contracts.
   Moderator: D. Alan Little
   Panelists: James F. Allen, Steve Radcliffe, Harold Singh

MR. IRWIN T. VANDERHOOF: In Volume XXXII of the Transactions of the Society of Actuaries, Mr. Aaron Tenenbein and I published a paper called "New Mathematical Laws of Select and Ultimate Mortality." At the 1980 International Congress of Actuaries, I authored a shorter version of this material using a somewhat different set of data to test the significance of the mathematical formulas. The proposed formulas fit the data very well with a value of R^2 equal to 99.1% for the 1965-70 select male data. The interested reader can check the values from the other tables tested from the given sources. The one figure I have given you is from the most recent and largest body of data, but it is also the highest value. The values for all recent data sets are still high enough to provide creditability for the mathematical formulation.

The general form of the proposed law of select mortality is that in each year after the initial selection, a portion of the standard lives has some departure from the standard life status into a substandard life status. We then postulate that we can associate with the substandard lives a number of the remaining standard lives and form a group of lives that exhibit ultimate mortality. Therefore, after the first year the initial group of standard lives can be broken into a group of lives that are still standard and a group that will exhibit ultimate mortality.

If the group created to exhibit the ultimate mortality remains a stable ultimate mortality group, then in the next year it can be augmented in the same way by another group of lives that were all standard at the end of the first year but became substandard in the second year and the necessary corresponding group of still standard lives. This leads to a formulation for the development of select mortality as a combination of standard mortality (first year select) and ultimate mortality:

$$q_{x+t} \; s \; + q_{x+t}(1 - s).$$

*Mr. Berger, not a member of the Society, is President of Cologne Life Reinsurance Company, Stamford, Connecticut.

In this formula, the factor "s" represents the portion of the lives that are standard at the beginning of any year that remain in the standard group at the end of the year. The remainder, a combination of standard and substandard lives, go into the ultimate group. The ultimate group always increases, and the standard group decreases exponentially.

For the seven sets of mortality data tested where the data is after 1944, the solved-for values of "s" varied from .76 to .823. For purposes of further discussion, the use of the value .8 would seem reasonable. The meaning of this factor is that out of a group of standard lives (all of whom could pass a medical) 80% will be in that group the next year, while 20% will be in a group, composed of substandard and standard lives, that will exhibit ultimate mortality.

This 20% will then include all of the lives who could not revert for a revertible term policy because of degeneration of mortality. We know that population mortality is about the same as ultimate mortality, so we should be able to assume that the order of magnitude of the number of lives in this group that are not standard is about the same as the lives in the population and among those who apply for insurance. We know from industry data that about 10% of the lives who apply for insurance cannot get it on standard terms. Applying the 10% to the 20% developed above, we would find that the order of magnitude of the percentage of lives that would not revert under a revertible term policy because of degeneration of physical condition would be about 2% per year. I believe that this is consistent with the experience of companies writing the business on an annual revertible term basis. From this, it is easy to derive the order of magnitude of the required premium for nonreverted lives and the expected nonreversion rates for longer periods.

An extension of the reasoning given above also leads to the interesting conclusion that of a group of substandard lives about 20% will return to standard status each year. There is no empirical corroboration of this number as yet.

MR. GOTTFRIED BERGER: Actuaries are believers, believers in the law of large numbers. Actuaries forecast mortality: for the purpose of pricing, to determine the GAAP value of a business, and so forth. To do so, we make two assumptions:

1. There is a "mortality table" which determines the expected mortality cost.

2. Any deviation of actual experience from expected is caused by random fluctuations; that is, the actual numbers are too small to make the law of large numbers work.

Of course, I have simplified, perhaps over-simplified. Indeed, there will be many instances where we do not know which mortality table to apply to a given book of business. Then we have to make guesses, and we may pick the wrong table. But we still believe there is a mortality table which determines future experience, except for random deviations.

We use mortality tables also in an entirely different context. We often say that mortality is 85% of intercompany, or mortality is 110% of expected. If we make such statements, we use mortality tables to weight the mix of attained ages and of policy ages. In other words, we use mortality tables to measure experienced mortality. More precisely, we use mortality tables to obtain a linear measure for a multi-dimensional experience.

Why multi-dimensional? It is easy to see two dimensions: attained age, policy age. But we could add health classes, such as preferred, standard, table-rated, and so forth. We can conceive a mortality table as at least a three-dimensional structure. The first two dimensions are expressly tabulated; the other dimensions are added conceptually. We actuaries provide this structure to the underwriter, who "classifies" each particular risk so that it fits into the structure.

Let us reflect briefly on risk classification. Everyone talks these days on risk differentiation by sex, which leads to the interesting question of conflicting moral requests, namely, fairness in pricing versus non-discrimination by sex. But this is not our topic. Besides, there are other risk differentiations which may have even greater impact.

There is growing recognition to expand risk classification by health status to the preferred side. Equally important may be the correlation between mortality and wealth. Many reinsurers continue to experience particularly bad results for high amounts. Quite recently, the chairman of Gulf & Western, Charles Bluhdorn, died of a heart attack in his corporate jet en route from Santo Domingo to New York. I wonder about this: a man in this position can certainly afford top health care, but he is also under permanent stress. If he had flown on a commercial jet, maybe there would have been a doctor on board, who knows.

Let me summarize. When it comes to mortality forecasts, we stipulate the existence of a mortality table which describes both the level of mortality and the geometrical pattern among different risk classes. These in turn depend upon age, health, and other factors.

How do we get the mortality tables? Obviously, there is a rich assortment at our disposal: population tables, the intercompany tables, annuity tables, and so forth. Many companies also compile their own experience.

As we have seen, we use the geometrical pattern of mortality tables to reduce the complexity of actual experience to one linear measure, which we may call the mortality level, say, 85% of intercompany. Here comes the first dilemma: the geometry is built in by the graduation process, which is to a large degree arbitrary. For instance, the Tenenbein-Vanderhoof paper presents three different "laws", each of which generates good graduations of the raw data which led to the "official" intercompany tables. These "laws" are just different graduations with respect to attained age and to policy age, but the ratios between select and ultimate mortality are significantly different. In other words, the measurement of the experienced mortality level depends largely upon the graduation assumptions which we build into the mortality tables.

The next dilemma is the tacit assumption that history repeats itself. Each mortality table describes what happened within a particular time epoch. But when we extrapolate into the future, we should recognize changing parameters, such as social behavior (drinking, smoking, exercising), medical achievements, and social conditions (inflation, unemployment). These two dilemmas make it difficult to choose the appropriate mortality table to forecast, or even measure, experience. We may have to apply techniques which convert mortality tables stemming from the observation of a fixed time epoch into mortality tables describing the expected mortality of a generation, say the generation of policies issued in the same year.

We shall now focus on a third dilemma, which has not yet been alluded to. We may say that each mortality table on insured lives is a "window". This window is opened and closed by the interested party, the policyholder. First, only those lives which apply for insurance and which are accepted, enter the observation. Second, each policyholder may close the window simply by letting his policy lapse. Does persistency, or lapse behavior, have an impact on the observation which leads to the mortality table? If that is the case, we have an additional uncertainty, because a change in lapse behavior may make select mortality tables obsolete. I do not know of any hard evidence which leads to the mortality table. I do not know of any hard evidence which could answer the question. Instead, I would like to describe a computer simulation which illustrates the impact of selected lapse behavior patterns.

Let us return once more to the concept of a multidimensional mortality table. We can divide the whole population into drinkers and non-drinkers, smokers and non-smokers, joggers and non-joggers, not to mention females and males. More important, we can separate those with cancer, those with heart impairments, and so forth. There is no end of what we could do, but obviously, things are becoming very complicated. One every idealized model is that of the numerical rating system. Of course, it is over-simplified, but it has served our business well for a very long time.

The model I am going to describe does not expressly assume the numerical rating system, but rather that the concept of health status may improve or deteriorate. In the model, all risks are subject to a mortality force which depends on only two parameters, attained age and health status, or, more precisely, health status relative to the attained age. Each risk performs a random walk as it enters the next policy age. It may keep the same health status, or else walk up or down to poorer or better health. So far, the model attempts to simulate Mother Nature, in that there are "lives" which grow older and die in accordance with probabilities attached to each state. If we measure the combined effect, we have a population mortality table.

We now turn to the one sample of the whole population we are interested in, the insured lives. They enter the observation (which leads to select tables such as the intercompany tables) by applying for insurance and being accepted.

It is often said that underwriters "select the good risks." Thus, the insured risks have, in the first policy year, a considerably better mortality than the overall population, but this "selection effect wears off over time." I propose that such statements are not only vague, but wrong. The underwriter does not select "good" risks, he merely attempts to put them into the appropriate risk class. Thus, risk classification is a better term than risk selection. The model I propose assumes that risks do not stay in the same risk class, because of the random walk alluded to earlier. Actually, it is not entirely a random walk. People can improve their survival chances, for instance, by giving up smoking. At any rate, the model considers three possibilities with respect to lapse behavior:

1. The policyholder's decision to renew or not to renew the policy is not influenced by his relative health status, or his subjective perception of it.

2. The policyholder is more inclined to keep the policy, the worse his relative health status.

3. The policyholder is more inclined to keep the policy, the worse the change in his relative health status.

The results of my computer experiment are hardly surprising. We observe the usual pattern of select mortality. Standard risks which start at a low relative mortality gradually approach the pattern of ultimate mortality. This is due to the random walk, which gradually wipes out the effect of risk classification. However, the approach to ultimate mortality is much faster, and much more in line with the intercompany tables, if we assume some antiselection on the part of the policyholder; that is, one of the latter two possibilities mentioned above.

This result implies that select mortality tables do not show the complete mortality development of <u>all</u> the risks which enter observation at issue date. The "geometry" of the mortality curve reflects lapses as well as mortality. We can therefore conclude:

1. Mortality experience for insurance policies will change if lapse behavior changes, even if the "true" mortality remains the same.

2. If mortality experience depends on persistency, then we must expect different mortality for plans which are different with respect to persistency incentives.

3. From the theoretical standpoint, mortality experience should be better if the persistency is better. Fortunately, good persistency helps also to recoup the acquisition costs faster. Thus, our problems are reduced to just one: find incentives which improve persistency.

MR. ALLEN BOOTH: My topic, today, has two focal points -- <u>design</u> and <u>pricing</u>. Although the two are intimately related, let us begin by agreeing that "design" encompasses items such as benefit features (renewability, convertibility, etc.), form (indeterminate premium, graded premium whole life, etc.), and marketing thrust (compensation, target market, etc.).

"Pricing" implies the setting of rates that will produce revenues sufficient to cover expenses and benefit costs while leaving a profit for the company.

Before dealing with either of these points, I would like to expand on the analyses presented by the previous speakers, who have set the stage well.

What critical pricing/design issues exist?

Your first reaction, a valid one, probably relates to your corporate product strategy. Specifically, how competitive should your product be? If your premise is that you wish to be in the upper tier of term specialists, then how can you stay current on battlefield developments? And, how can you build a competitive rate scale without giving away your future?

My litany of critical issues begins from a more fundamental plane.

1. Antiselection implicit in Select and Ultimate Rate Scales.

2. Replacement and resulting lapse rates.

3. Expense inflation

4. What value 818(c)

5. Deficiency Reserves

The focus of today's presentation is clearly on the first two of these. Let us begin by considering antiselection. Realistically, the subject of antiselection cannot be separated from the subject of replacement.

The antiselection considered here is of a specific nature: To what extent will lapsation alter the mix (post-issue) of continuing select lives and of lives whose underlying health characteristics are deteriorating? Mr. Vanderhoof spoke of the deterioration of the mortality expectation resulting from the maturing of a totally select group into an ultimate group. My question is: to what extent will the lapses come from the lives still select and what are the implications for the remaining insureds?

It seems intuitively obvious that an inordinate proportion of the "lapsers" will be select and that those whose health has deteriorated will tend to persist. It is important to notice that, unlike whole life insurance where a replacement at a higher age will often result in a higher premium and a retardation of cash value growth, term insurance replacements can frequently be effected for a reduction in premium and no apparent loss of other benefits.

You may, in fact, be selling revertible term and do not know it. How profound might this phenomena be? What factors affect it?

- <u>Market/Sales Sophistication</u>
  - More sophistication implies more antiselection

- Salesman Loyalty
  - Less Loyalty implies more antiselection
  - Brokerage --- PPGA --- Career (Captive)
  - Control factor (agent controlling client)
  - Underwrite for new policy before dropping old

- Underwriting Intensity
  - More Intense implies more antiselection
  - Initial cohort more super select

- Rate Competitiveness
  - Steeper renewal rate scale implies more antiselection

- Commission Level
  - Steeper commission scale implies more antiselection

In order to illustrate the potential impact of the impact of replacement on ultimate mortality experience, we will use an analytical model. In the model, certain key variables will be studied, using a baseline scenario and then varying each factor independently.

Underlying Mortality	100% of '65 - '70 SU	The underlying mortality assumption reflects expected mortality, absent the replacement antiselection phenomena.
Underlying Persistency	2/3 of Linton B	The underlying persistency assumption reflects a "normal" lapse pattern resulting from general policyowner dissatisfaction, changed needs, and changed life style.
Actual Lapsation	20%/15%/10%	The actual lapsation factor predicts lapses in the term environment, subject to an assumed impact of replacement and competition.
Selection Coefficient	60%	The selection coefficient addresses the question of policyholder knowledge and his ability to act most prudently in his own best interest.

A selection coeffecient of 100% would imply that all continuing select lives routinely shop for "the best current rate" and, more importantly, that all insureds whose health is deteriorating will avoid replacing their current policies. Policyowner inertia will likely prevent the coefficient from operating at 100%, but it should be clear that, where the agent is active in reviewing rates and communicating knowledge to the insured, the coefficient will be higher than where the agent's actions are oriented to keeping the current policy inforce regardless of competitor and replacement opportunities.

The baseline results are shown in Table 1, using selection coefficients of 100%, 60%, and 20%.

Certain observations should be made relative to the baseline example:

- The chosen selection coefficient has a major impact, and mortality antiselection should be expected to be more profound where sales are made with a high degree of rate consciousness and agent control.

- The experience trends will be masked for several years, with antiselection severity becoming obvious and important only after several years. In the early years of a block of term business it is not unlikely that population mortality improvements or statistical deviations will serve to incorrectly convince the company and its actuaries that the mortality characteristics of the block are very favorable.

In the next example we have fixed the selection coefficient at 60% and analyzed the impact of alternative levels of term insurance plan lapsation (Table 2).

Again, two conclusions surface:

- The <u>ultimate</u> lapse rate will be a key determinant of actual mortality antiselection.

- The magnitude of the antiselection factor can, potentially, become so large as to defeat any attempt to "properly" rate the ultimate portion of the risk.

In the next example, the effect of the underlying assumed mortality (pre-antiselection) is considered. The example is not terribly interesting, except to note the third column (Q = 60-90%) demonstrates the effect of a graduated mortality assumption, i.e., 60% of the 1965-70 table, graded to 90% in the 15th year (Table 3).

Finally, the analysis has been extended to issue ages other than age 35 using the aforementioned baseline assumptions (Table 4).

In summation, the obvious conclusions to be drawn are:

1. The potential magnitude of antiselection induced by excess lapsation is large and should cause us concern.

2. The antiselection phenomenon is related as much or more to the company's marketing methods and distribution systems as it is to its underwriting standards.

3. It appears that many companies are merely guessing when it comes to setting longer term assumptions and rates.

4. One would expect that the reinsurers will be the recipients of the most bad news due to their involvement with the larger, more competitive cases.

5. It is difficult to be critical of the agent since his actions are generally motivated by both his and his client's best interests.

Aside from pricing your company out of the market, what courses of actions might be available to the product development actuary?

First, it should be common practice to incorporate analyses of significant antiselection in the rating process. Although the initial "guess" by many is that, since antiselection happens at longer durations when relatively little inforce remains, the impact on profitability will be minimal. Such a knee-jerk conclusion is unwarranted.

Next, coupling select and ultimate rates with extended (e.g. to age 100) renewability begets the worst of both worlds. Consider, on particularly competitive merchandise, limiting renewability. Limiting convertibility may be nearly as important.

Recently, profound logic has seemed to reside in the tax and reinsurance effecting of profit analysis. This is fine in the short range, but be particularly aware of the potential for loss of the imputed (818c) tax benefit.

Finally, to the extent possible within your corporate environment, endeavor to replace the first year price focus with some alternative marketing or sales factor.

Summary of Panel Discussion on The Developing Experience Under These Contracts

This session was a follow-up to the theoretical presentations made earlier that morning. The discussions centered on actual company experience of certain direct writers as well as actual reinsurance company experience which should parallel some of the direct writers experience on large amount term plans.

In general, there was agreement that persistency over the past five years has deteriorated for all ages, policy sizes and durations. The higher policy sizes showed higher lapse rates. Lapse rates varied by age, policy size and duration. The lapse rates appear to level off after 3 years at a rate significantly higher than many actuaries have anticipated in the pricing structure. Some lapse rates actually increase by duration on select and ultimate plans. There was surprising similarity between the lapse rates that were shown for all of the companies, regardless of whether the company was a reinsurance company or a direct writing company.

There also appeared to be agreement among the companies that mortality rates have been greater than expected for years 1980 - 1982. This may be either a fluctuation or a trend and may possibly be due to the recession and increased stress in the population. It was indicated by at least one company that the mortality ratios of actual to experience were in excess of 120% for the years 1980 - 1982. It is probably too early to make a correlation between the high lapse rates and increased mortality rates that was developed theoretically in the earlier session, especially since other facts, e.g., the economy and stress, may be important contributing factors at this time.

The need for more detailed financial underwriting was brought out by almost all the participants. One company's experience shows that violent deaths have been the leading cause of death by face amount for the last three years, averaging almost 37% for each of the years.

During the discussion phase, many of the comments reinforced the experience presented by the panelists.

TABLE 1

BASELINE RESULTS

COMMON ASSUMPTIONS:

MORTALITY = 100% OF 65-70

PERSISTENCY = 2/3 OF LINTON B

PLAN LAPSE = 20/15/10

ISSUE AGE = 35

VARIABLE ASSUMPTION : COEFFICIENT

RESULTS:

	MORTALITY AS % OF ASSUMED		
YEAR	Co = 100%	Co = 60%	Co = 20%
1	100.0%	100.0%	100.0%
2	101.1	100.7	100.2
5	106.4	103.9	101.3
10	123.2	113.9	104.6
20	218.0	170.8	123.6
30	435.3	301.2	167.1

TABLE 2
INFLUENCE OF LAPSE EXPERIENCE

COMMON ASSUMPTIONS:

MORTALITY = 100% OF 65-70

PERSISTENCY = 2/3 OF LINTON B

COEFFICIENT = 60%

ISSUE AGE = 35

VARIABLE ASSUMPTION:

PLAN LAPSE = SEE TABLE

	MORTALITY AS % OF ASSUMED			
YEAR	PL = 20-15-10	30-22½-15	20 LEVEL	10 LEVEL
1	100.0%	100.0%	100.0%	100.0%
2	100.7	101.8	100.7	99.7
5	103.9	110.5	111.2	101.6
10	113.9	138.5	161.1	110.6
20	170.8	344.7	723.9	161.4
30	301.2	1138.4	4579.4	285.7

TABLE 3
INFLUENCE OF UNDERLYING MORTALITY

COMMON ASSUMPTIONS:

PERSISTENCY = 2/3 OF LINTON B

PLAN LAPSE = 20/15/10

COEFFICIENT = 60%

ISSUE AGE = 35

VARIABLE ASSUMPTION:

MORTALITY = SEE TABLE

	MORTALITY AS % OF ASSUMED		
YEAR	Q = 100%	Q = 85%	Q = 60-90%
1	100.0%	100.0%	100.0%
2	100.7	100.7	100.8
5	103.9	103.9	104.4
10	113.9	113.9	116.4
20	170.8	170.8	183.6
30	301.2	301.2	335.1

TABLE 4
VARIATIONS BY AGE

YEAR	AGE 35	AGE 45	AGE 55
1	100.0%	100.0%	100.0%
2	100.7	101.2	101.7
5	103.9	106.0	107.2
10	113.9	120.9	121.7
20	170.8	188.1	187.1
30	301.2	330.9	326.0