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HEALTH INSURANCE SURPLUS REQUIREMENTS AND MANAGEMENT

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Recorder: ALBERT D. COLE

- How is health insurance risk measured?
- Do surplus requirements differ between health insurance and life insurance? Why? How?
- Do surplus requirements differ among health insurers (e.g., Commercial, Blue Cross, HMO), among health insurance products? Why? How?
- What are some of the current techniques being used by health insurers for determining target or required surplus? For managing surplus?
- How do the rating agencies view surplus requirements for health insurers?

MR. DONALD M. PETERSON: Our panelists, in the order that they will be speaking, are Bill Weller, Senior Actuary with the Health Insurance Association of America (HIAA) in Washington, D.C.; Tom Snook, Consulting Actuary with Milliman and Robertson in Houston; and Chuck Fuhrer, Pricing Actuary with Washington National Insurance Company in Evanston, Illinois. Our recorder is Bert Cole, Associate Actuary at Benefit Trust Life.

I think we have a timely and interesting topic. Names such as First Executive, First Capital, Monarch, Mutual Benefit, Equitable and others have hit the headlines recently due to problems involving junk bonds, real estate, and mortgage investments. There are a number of insurers, HMOs, multiple employer trusts, and Blue Cross organizations coming upon troubled financial times right now. Some of our friends associated with A.M. Best's, Moody's, Standard & Poor's (S&P), Duff and Phelps, and some of the other less credible rating agencies are looking very cautiously at insurers' assets, their rates of growth, their capitalization, and the risks that they are underwriting. Foremost among these risks, upon which they look rather unfavorably right now, are health care and health insurance. Most recently, the National Association of Insurance Commissioners (NAIC) has been studying surplus requirements, and I understand now the Health Insurance Association of America will begin initiating some activity on the subject as well. With that as very brief background, we will start off with Bill.

MR. WILLIAM C. WELLER: I have been asked to address the health insurance solvency requirements from viewpoints outside the company. These include the rating agencies that Don just mentioned, the NAIC, and state regulators. For these people, health insurance risk measurement is constrained by the consolidation of many different products and funding arrangements into frequently inappropriate, at least for their purposes, renewal provision distinctions in the Annual Statement. That is, we separate noncancellable from guaranteed renewable, but we do not separate disability income from hospital indemnity from major medical, and those are the distinctions that they feel are more important. Offsetting this is the fact that relative to the total of all risks of the insurer either, (1) health insurance is a small portion of the company's business; (2) the company will provide the necessary information to

obtain a claims-paying rating for Moody's or Standard and Poor's; or (3) broad underwriting and operational information from the Annual Statement Schedule H and page 14B shows reasonable results, and from this it can be inferred that the company is either seeking or not seeking, as appropriate, necessary rate increases on a timely basis.

Thus, to date, health insurance risk measurement has been on a very gross basis, applying a factor or a set of factors to the premium income with detail limited to splitting by group versus individual. Credit insurance generally gets lumped in with individual. For example, Moody's uses 25% of individual premium and 10% of group premium from Page 5; New York and Minnesota use much the same factors. Utah uses a 10% factor and Wisconsin uses 15% for its base requirement. S&P has used a premium-to-surplus ratio, much like the property and casualty approach, in terms of trying to rank companies into their various categories. However, at this point, it is not ready to distribute its total basis for its quality rankings.

Surplus requirements must be viewed in total for the company, and should change in accordance with the types, levels, and amounts of risk assumed. This has been called dynamic surplus, or risk-based capital. An NAIC task force was formed to develop risk-based capital values for insurers. It is broken into two parts, one for life and health and the other for property and casualty, and an advisory committee was created for each. The advisory committee for life and health was then split into a number of subcommittees that looked at each of the various risk elements: the C-1 risk on assets; C-2 risk on reserves and pricing; C-3 risk on the asset liability matching; and C-4 risk on management risk. There is a small-company group, and finally there is an overall group that is reviewing how this is going to be used. The aim is to develop factors that are appropriate for the various risks and risk variations. These will then need to be combined -- presumably by algorithm -- to develop a risk-based capital value which will, in all likelihood, become part of the annual statement. The ratio of your capital plus surplus plus mandatory securities valuation reserve (MSVR) to this number will also become part of your annual statement. There will also likely be a model bill -- part of the NAIC Solvency and Accreditation Program -- which will provide guidelines for insurance department action when the ratio drops below specified "trigger points." We are still in the initial stages of the whole process.

I would like to turn now to the health components of the risk-based capital model, as developed to date by the advisory committee. We looked at six areas with different health risks: (1) individual disability income (assumed to be noncancellable and guaranteed renewable); (2) group long-term disability (LTD); (3) group accidental death and dismemberment (AD&D); (4) credit disability; (5) other group accident and health (A&H) (assumed to be medical expense reimbursement); and, (6) other individual A&H, (also assumed to be medical expense reimbursement).

For individual disability income, the risks are the pricing-to-risk assumptions, particularly for benefit expansions; random fluctuations, or nonrandom economic-based changes in the incidence and length of disability; and changes in long-term trends in disability resulting in inadequate reserve levels, as well as deficient premiums. For group LTD, the risks are the same as individual, although there are less benefit expansions, and the factor for premium can be lower because of the ability to coordinate with social security benefits, and there is a greater chance to adjust your

premiums, year to year, based upon experience. The factors being considered for both are earned premium, with some variation by the size of the disability block; claim reserves from Exhibit 9; and an offset for a percentage of active life reserves held, the idea being that a newer block has maybe a little bit more risk than a more mature block.

For group AD&D, the risk is catastrophic, and therefore the factor should be related to the amount of accidental death exposure, as opposed to earned premium, if the size of the block is significant.

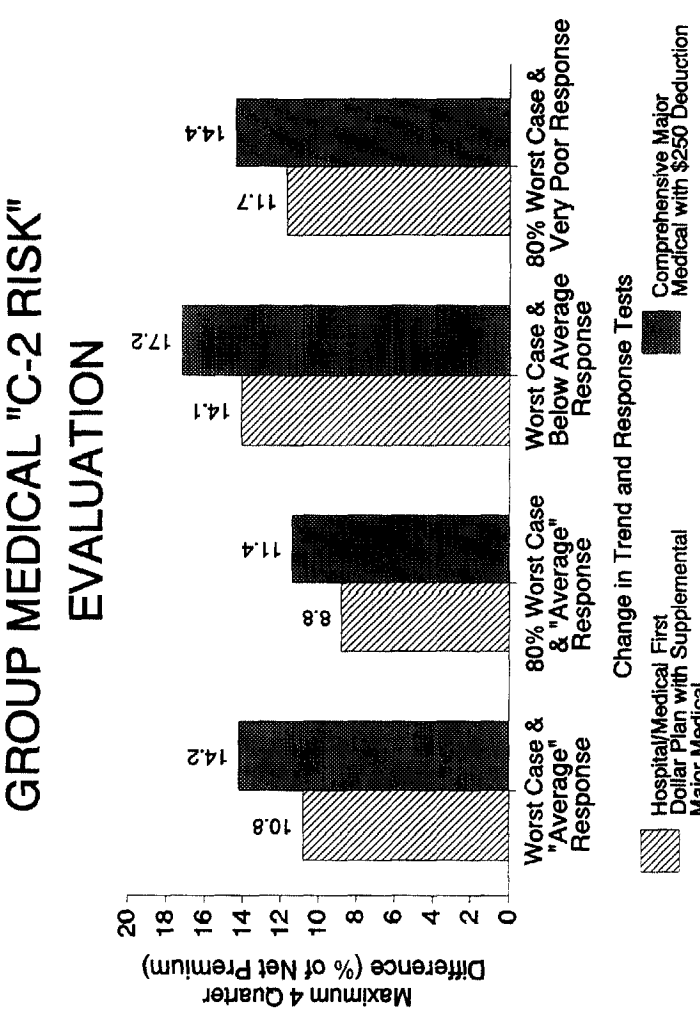
For credit disability, the risks are similar to group LTD, with a potential additional risk of having too high a commission level for new business. Offsetting all of these is the conservative approach of using gross unearned premium reserves, while recognizing all expenses at the time of issue on single-premium business.

For group A&H, which obviously comprises the vast majority of the total health insurance premium in the industry, the major risks are the understatement of trend, an epidemic which is too rapid to properly reflect in rates; restrictions on underwriting and rating practices, a new development in the small group market, where states are introducing some combination of guaranteed issue and community rating requirements; and expansion of business without solid and valid experience data to use for pricing. Without any backup data, we decided that of the first two, "missing the trend" was a greater risk to company solvency than an epidemic. It was assumed that in the event of an epidemic, much of the care provided would replace current care for elective procedures and defensive medicine. The same offset cannot be expected when the trend increases. Thus a study was done of the potential effects of a trend increase based on the largest historical increase in the medical CPI annual trends.

We looked at the largest increase in the medical CPI trend over two years versus the three years prior to that. We looked at the risk when products priced on the basis of historical trend had to be changed to the worst case. We developed a model that allowed variations in the time and manner for responding. That allowed us to have what we called an average response rate. We also have a below-average response rate, which has slower corrections to premiums, and then we have a very poor response rate. We were then able to look at the impact of this on several plans: first, a hospital/medical/surgical plan, which we felt would have numbers fairly close to the medical CPI with some addition for cost shifting; and second, a comprehensive medical with a $250 deductible, so there is a slight amount of deductible compression. We found that the worst historical trend change happened right after the price controls in the early 1970s were eliminated.

Chart 1 shows the effects of the worst historical trend change, as well as 80% of the worst case. For each plan, it shows the ratio of "correct" net premium based on actual trend to the net premium based on pricing trend. The maximum ratio over a three-year period is shown. The effects will vary depending on the speed and reactive ability of each company. Some of the limitation is contractual or external (i.e., rate guarantee periods, in-house versus outside claims processing), while much is internal (i.e., marketing versus financial issues, the dependence on internal numbers versus industry trends, etc.). Management would have to ignore pretty significant

CHART 1


GROUP MEDICAL "C-2 RISK"
EVALUATION
Maximum 4 Quarter
Difference (% of Net Premium)
0
2
4
6
8
10
12
14
16
18
20
10.8
14.2
8.8
11.4
14.1
17.2
11.7
14.4
Worst Case & "Average" Response
80% Worst Case & "Average" Response
Worst Case & Below Average Response
80% Worst Case & Very Poor Response
Change in Trend and Response Tests
Hospital/Medical First Dollar Plan with Supplemental Major Medical
Comprehensive Major Medical with $250 Deduction

deviations from the expected to need more than 12% or 15% of claims costs, and only a company with a small amount of group health would be able to tolerate any lengthy delay.

We then studied the effect of one-year versus two-year increases in trend by varying the portion of the total increase which would occur in the first of the two years. We also assumed a cost shift of 2% in the first year and 4% in the second year, on the basis that if trends are going up for us, they are also going up for government plans, but will be subject to controls on the amount paid by government. Chart 2 shows that there is relatively little effect, other than the effect from cost shift, on whether or not the trend is heavily weighted toward one year or the other.

The final aspect of the study was to look at benefit variations, concentrating on deductible levels. Adjusting the base trend for higher deductibles and the effects of deductible compression, Chart 3 shows that this aspect has a significant effect on the maximum risk. Unfortunately, the distribution of health premium by deductible is very difficult to obtain. Is it worth the cost to get this level of data?

This concludes my presentation, and I would like to now introduce Tom Snook, who will be discussing HMO surplus requirements and variations among companies.

MR. THOMAS D. SNOOK: As Bill mentioned, the focus of my talk is going to be on actual insurance company practices regarding setting surplus for their health insurance lines, and I will be presenting the results of a survey regarding that. I also will be talking a little bit about how surplus needs for HMOs differ from insurers.

Before I get into that, I want to express my opinion on the regulatory activity that Bill talked about. We do some work in the Houston office of Milliman & Robertson with the Texas State Board of Insurance Liquidation Division, the division that seizes insurers if they are insolvent. Our job is to analyze claim reserves and help determine the guarantee fund's total bill; you might think of this as actuarial coroner work. All of the insurance company deaths I have encountered have been small insurance companies. Texas minimum capital and surplus levels have been fairly low in the past; they have recently raised them, but that made Texas something of a haven for small insurance companies. Many of the companies I worked with were also in the small group major medical line, which we know to be somewhat volatile.

The reason these companies went broke, simply put, is that they had poor quality management. They wrote very, very large quantities of business very quickly at inadequate rates that were set more from a marketing standpoint than an actuarial one. At first, management was happy -- it was getting good paid-loss ratios. Of course, the incurred but not reported claims caught up with it, and it had to put through some large rate increases, and it got caught in an assessment spiral. If you have got $20 million of major medical premium in force, it does not take a whole lot of underpricing for that one million of surplus to go away. My point is that there is a need for what the NAIC is doing and I think that, although you could raise some objections about the development of objective methods that will work for each company, we have been taking a little bit of heat in the press, and maybe we need to be doing something.

GROUP MEDICAL "C-2 RISK" EVALUATION

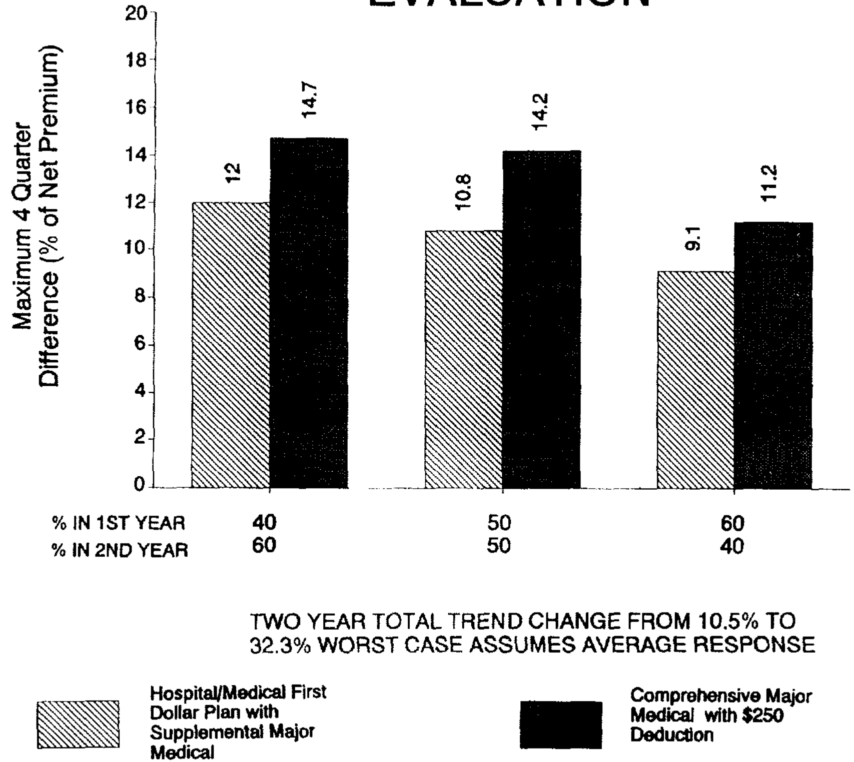
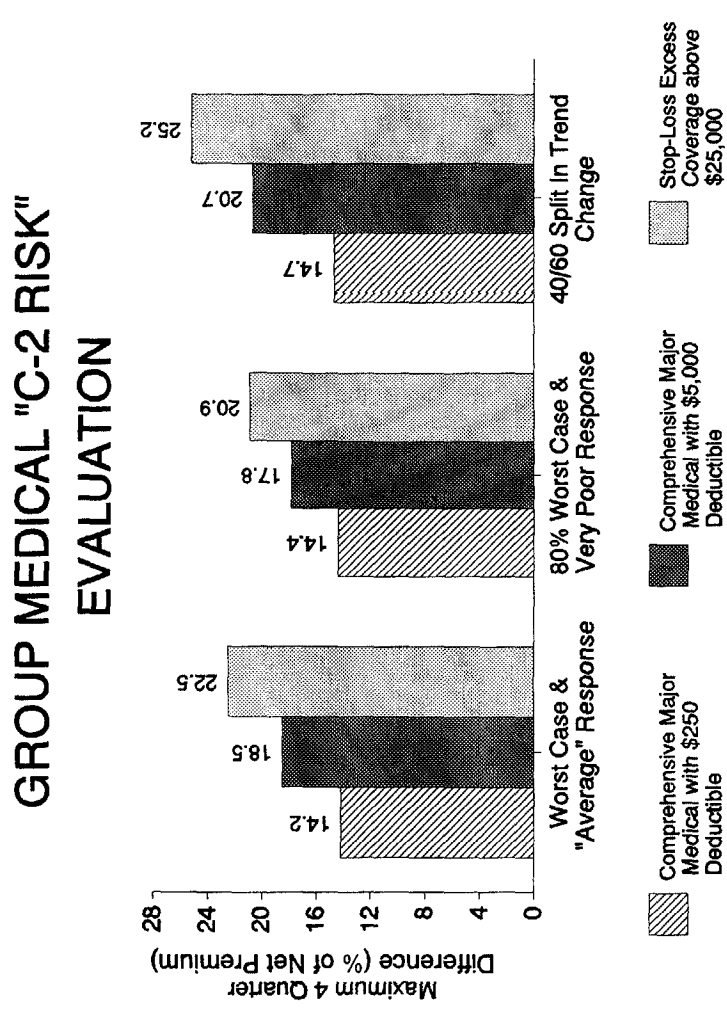


CHART 3


GROUP MEDICAL "C-2 RISK" EVALUATION
Maximum 4 Quarter Difference (% of Net Premium)
0
4
8
12
16
20
24
28
14.2
18.5
22.5
14.4
17.8
20.9
14.7
20.7
25.2
Worst Case & "Average" Response
80% Worst Case & Very Poor Response
40/60 Split In Trend Change
Comprehensive Major Medical with $250 Deductible
Comprehensive Major Medical with $5,000 Deductible
Stop-Loss Excess Coverage above $25,000

SURPLUS NEEDS FOR HMOS

HMOs, of course, will hold surplus for the same reasons that an insurance company does: to meet the statutory requirements, finance growth, and assume the risk of doing business. Where the HMOs are different, though, is in the nature of their C-2 risk. One way that they are different is that they have a less diverse spread of risk than a multiline insurer. Many insurance companies will write not only health, but life, group life, individual life, AD&D, and LTD, and this gives them a more diversified risk portfolio than an HMO does. So, in that respect, the HMO's C-2 risk can be thought to be higher, when you look at the entity as a whole.

I think there are other reasons that indicate that an HMO might really need to hold less surplus, the main one being that, frequently, some or most of the actual C-2 risk is transferred to the providers. The degree of transfer will vary by the model of the HMO. Under a staff model, the HMO is both provider and insurer, and the HMO still bears the full risk of excess claims, but since the physicians are generally paid on a salary basis, that risk is limited, and you would also expect some control over the volume and type of care provided. Under the group model HMO, a significant portion of the net claim cost will be capitated; in other words, the providers will be paid a fixed fee, per member per month, in exchange for medical services. When this arrangement is set up, the provider, then, is assuming the risk of excess claims. The individual practice association (IPA) model is most like the insurance product, typically on a discounted fee-for-service basis, and as such would have the greatest C-2 risk.

Finally, I would also hold that the managed care environment itself should yield less claims variability than an unmanaged environment. Managed care seeks to rationalize the health care delivery practices to achieve the goal of reduced claim costs. I think as a by-product of this, we should get reduced claims variability. Also, provider delivery practices vary a great deal, even within a state. An HMO, by severely restricting the providers, should have less variability in the approach to providing care and will get some risk reduction out of that.

INSURANCE COMPANY SURPLUS PRACTICES

As Bill mentioned, traditionally surplus needs for health business have been set as a percentage of premium plus, say, reserves for LTD. The common approach is typically a rule-of-thumb approach, much as it is for the rating agencies. There has been a lot of actuarial theory developed in this area; but I would say that setting surplus is somewhat more art than science. I think there are good reasons for surplus needs to vary from company to company: company size and the other lines it writes, underwriting practices, reinsurance agreements, and the amount of conservatism in pricing and valuation the company employs. For example, if you've put a 10% margin on your best-guess incurred but not reported (IBNR) reserve, then you would need that much less surplus.

The purpose of the survey was to see what companies were doing to allocate total company surplus to the health lines. This is a little different from required or target surplus; here we know the total surplus, and we want to allocate it to the lines. Why would we want to do this? Simply put, I think to manage surplus you are going to need to first quantify it. Statutory and GAAP accounting only measure surplus in total. As Bill mentioned, different lines have different risk, and hence different needs for surplus. Therefore, I think surplus management should consider each line

separately, as well as in total. There are two general approaches to allocating surplus. One I will call the formula approach, which really is just allocating what you think your target surplus is for the line, and then any excess or deficit in the company as a whole is called corporate surplus, and measures the amount you are over or under your target. The other is what I will call the financial approach, where the surplus is set equal to the accumulated profits for the line. This effectively treats each line as its own company.

I sent a questionnaire to a hundred actuaries working for insurance companies in the United States and Canada. My goal was to identify a list of health actuaries who could knowledgeably complete the questionnaire. It was a fairly crude method, I will admit; I limited my mailing to actuaries simply to optimize my return rate -- I had no other reason. In selecting the survey sample, I identified a list of insurance companies who actually do employ members of the Health Section of the Society of Actuaries, and I excluded the Blues, reinsurers and non-North American companies, just to narrow the focus of the survey somewhat. Through this, I identified 285 companies. I chose every third company plus five at random to give me a hundred companies. I then went to the job titles in the yearbook and identified the actuaries who should receive the questionnaire. Of the 100 I sent out, I got 28 back; of those 28, only 23 could be considered bona fide, because five wrote that they had gotten out of the health lines of business.

I asked for company information: U.S. or Canada, stock or mutual, A.M. Best size category and rating, and the number of states or provinces in which they were licensed. I also asked for the name of the company and the person I could contact, simply so I could send out the compiled results to them. I am not going to tell you who is doing what right now, but I will tell you what is being done.

I asked for premium information by product category, both group and individual. I asked about surplus allocation: do you allocate surplus and if so, why? They were given a list of choices. Then I asked the respondents that do allocate surplus to describe the methods that they use for group and individual lines. The last question, for those who do not allocate surplus, was a list of choices as to why they do not allocate surplus.

Of the 28 responses, five no longer write health insurance. Eleven do allocate surplus, and 12 do not allocate surplus. This is probably a higher proportion, I think, than allocate surplus industrywide. I would think that those who do allocate are probably more interested and more likely to respond; the companies that do allocate surplus are the companies who are actively managing their surplus. The small companies are not quite as active in that.

Why do you not allocate surplus? Seven companies responded, "It's not important, so we don't bother." Two said, "We've only got one line of business in the company." Two said, "It's important in theory but it's not meaningful in practice." And one said, "It's inconsistent with our management philosophy." Two of the twelve "don'ts" indicated that they were interested in the topic, and that they were going to try to implement something in the future. Not surprising, the companies that do allocate surplus are bigger than the companies that do not. For the companies that do not allocate surplus, their Best size categories ranged from III to IX, and had ratings

from C+ to A+. The companies that do allocate ranged from VI to XV, XV being the largest possible, and only two of the eleven were VI, everybody else was IX to XV; and they were all at least an A-. In total, I will note that the respondents accounted for $7 billion of health annualized premium in force, of which the companies that do allocate surplus accounted for 6.2 billion.

Why do you allocate surplus? "Measure return on equity" was the most popular choice -- eight people chose that. Four chose "Cover all risks and fund growth;" four chose "cover all risks;" and nobody said, "cover the C-2 risk only." (This adds up to more than eleven, because you could check more than one box.) All but one of the eleven companies uses a formula approach to allocate surplus. The other company uses what I called a financial approach with accumulated surplus.

The formulas vary quite a bit. The two biggest companies that were in the survey, which are both very large companies, were the only ones that vary their formulas by product category. The rest might split between individual and group.

For big company A, their surplus allocated for the C-1 risk is based on an analysis of assets. For the C-2 risk, they are taking a sum of the excesses only of 125% of group health claims over premiums and reserves, and for individual lines, 13% of medical and noncancellable disability premium, and 26% of guaranteed renewable disability premium. Surplus for the C-4 risk is based on a business analysis, where they take a look at the potential bankruptcies of large group customers, pending lawsuits, pending legislative actions, etc.

Big company B has a fairly complicated formula where they take percentages of premiums, depending on the type of premium, conventional premiums, pooled premium, or premium equivalents for its ASO business, plus 2% of its liabilities for its group medical, short-term disability, and AD&D lines. For the multiple employer trust, it does the same thing, but it holds a little more surplus because of the perceived extra risk, where it is using 20% of conventional premiums. And for the group LTD, it is holding 12% of premiums plus 4% of the Exhibit 9B reserve.

Some other companies' formulas are:

- 10% of group plus 25% of individual premium;
- 10% of premium plus 5% of reserves;
- 17.5% of premium plus reserves;
- 7% of premium plus reserves;
- 105% of (20% of premium and 1.8% of reserves);
- 9.7% of premium;
- "Based on Best's Requirements."

In summary, company practices vary a great deal with respect to setting surplus for their health lines, and as I mentioned, there may be good reasons why this is so, because the needs can vary from company to company. But I think this is an area where we as actuaries might want to substitute demonstrations for impressions, and I think that is what Chuck is going to get into.

MR. CHARLES S. FUHRER: I am glad that Tom concluded that way. I cringed when he said that setting surplus levels was an art, not a science. I think that it is not an

exact science, but I do believe it is a science. In fact, I think that a lot of people did not feel like taking the time to look at the issues. Because there are various kinds of variability, or uncertainty of the results of our business that are not those that are normally subject to statistical analysis, sometimes they have concluded that nothing can be done. I maintain, on the contrary, that we can model almost any kind of variability we want. The only questions are, How clever are we in doing so and how much time do we have? Time can be very important, because even modern computers tend to run rather slowly on complicated problems.

With that in mind, what I would like to do is present some calculations that I did to estimate required surplus for various types of group health insurance. Part of the motivation in presenting this is to show that we can do this sort of calculation, and arrive at answers. We do not have to guess at the answers, and we do not have to use the industry averages. First of all, the only thing I looked at was the claim fluctuation risk, sometimes called C-2. I think that in the insurance business the actuary is most concerned about claim fluctuation, although some actuaries have gotten into asset evaluation, etc. Do not think that because I only did the C-2 risk that some of the other risks are not subject to the same kind of analysis. In fact, we probably could combine the analysis of all of the risk to give us an overall surplus. The method I used was ruin theory, which was the approach used by Allan Brender in his article, "Required Surplus for the Insurance Risk for Certain Lines of Group Insurance," *TSA* XXXVI, pp. 9-35, 1984.

In order to use ruin theory, we have to set a probability of ruin as our basic input into the process of making the surplus calculation. If we are willing to accept a 50% chance of ruin, then obviously we do not need very much surplus. If we are only willing to accept a probability of ruin of 0.1%, then we need a large amount of surplus. The truth is, selection of that probability is completely arbitrary. I cannot think of any particular way that anybody could prove that 1% is something acceptable, but 5% is not. There are certain ways of thinking about those probabilities, and even comparing them with certain risks involved in, for example, investments. We could compare our return on investments to our stockholders (in the case of a stock company), and our probability of ruin versus the default risk in a bond portfolio with an equivalent return.

There is another reason for doing these calculations, and that is it allows you to compare what your surplus requirements are for various kinds of health insurance. We can compare stop-loss coverage with regular group medical insurance. We could look at the excess of loss individual reinsurance; many companies will buy that kind of reinsurance so that they need not worry about the large claim bankrupting them. What happens to the probability of ruin, or how much is the required surplus reduced if reinsurance is purchased? That is one question that can be answered; a related question is what would be the relative riskiness of the various products. If we can compare how much required surplus we need for each product, we could then decide if we want to get into that product in a particular market. This is a tool for management decision-making. Finally, there is a question of what to charge for surplus. For the purpose of this talk, I will call these charges margin. We need to know how much we are going to charge our customers for surplus. If we are going to be equitable and the market will bear it, we will charge the riskier products a greater margin than our less-risky products.

I had to modify what is normally done in ruin theory a little bit. Normally one assumes a given margin level, and then calculates the probability of ruin and the required surplus. Most companies will set a margin level to maintain their required surplus; it doesn't make a lot of sense, under inflationary conditions, for the insurance company to plan on not having enough surplus. If you take a relatively simple model for surplus (see Table 1) and assume that your prior year surplus is going to grow with interest, and assume that you want to charge just enough margin in your premium rates so that you will have that same percentage of net premium as your surplus at the end of each year, then you can derive the first formula. Formula (1) says that the margin you need is exactly equal to your surplus rate multiplied by a factor which equals your trend rate, minus your interest rate, plus the desired rate of return to stockholders. Clearly the margin has to be big enough to provide the increase in surplus you will need to keep up with the trend and to provide enough money to reward the stockholders, but is reduced by the amount of interest you can earn on that surplus. We can do the ruin theory calculation of the probability of ruin, or conversely, start with the probability of ruin and calculate the total safety that we need (margin plus surplus). We get *m* plus *s*, and then can work backwards, from Formula (1), and arrive at an allocation where the surplus equals *m* plus *s* over one plus *t* plus *r* minus *i*, and the margin is what is left. If you combine Formulas (1) and (2) you get Formula (3).

TABLE 1
Basic Surplus Model

Let	s	=	Surplus Rate = Surplus/Net Premium;	
	m	=	Net Premium Load = Margin (nonrefundable) = Profit Charges;	
	r	=	Return to Stockholders Rate = Dividends/Surplus;	
	t	=	Constant Trend (including growth) Rate; and	
	i	=	Constant Interest Rate.	
Then	m	=	$s(t+r-i)$	(1),
	s	=	$(m+s) / (1+t+r-i)$	(2),
	m	=	$(m+s)(t+r-i) / (1+t+r-i)$	(3).

A lot of the ruin theory calculations that you have seen have dealt with an infinite time horizon, but for a number of reasons, I decided to do these calculations for only a one-year time period. The four reasons for doing so are: (1) that infinite time is a little bit longer than we care to deal with; (2) for the simpler models that most of the ruin theory articles have dealt with, calculating over an infinite time is not much harder, and can sometimes be easier than calculating it for one year, but for my models this may not be true; (3) an infinite time horizon and a short time horizon are really the same anyway, because generally, if ruin occurs, it occurs in the very early years, depending on the model involved; and (4) it has been shown in a paper by an Australian actuary named Greg Taylor ("Probability of Ruin Under Inflationary Conditions or Under Experience Rating," *ASTIN* Vol. 10, 1979) that under any assumption of inflation, infinite time ruin is certain.

The point of that paper is that if you assume inflation, the initial surplus will always eventually be swamped by the growth in premiums. Consequently, it does not matter how much surplus or prior margins have been built up, you are constantly

faced with the possibility of ruin, and if you run that over a long enough time, you are going to end up with a ruin at some time. Rather than dealing with the inflation question under that basis, I chose to deal with it as under the prior formulas, where given a certain assumption about inflation and interest, we could actually determine our margin needs, and the only thing we need to calculate is the required safety.

The next thing that I had to do was to model the real situation with group health insurance. I could not merely use a claims size and frequency random variable, because that ignores two very important sources of variability in health insurance. For the calculations shown in Tables 2-10, the claim distribution assumed is the product of three random variables. The first one is the standard claim size and frequency random variable, which I assume to be compound Poisson, and the size and frequency table is Table 2. That particular table was derived from some data I got at my prior employer, Blue Cross/Blue Shield of Illinois, and it is a discreet distribution, in thousands, and the only thing wrong with it, is that it is a couple of years old. But, it does not change the validity of the calculation, if we assume the slope does not change. If you look at Table 2, you will see that there are small probabilities at 519,000 and 520,000. The reason is that I have formed this distribution from the data, but each claim is assumed to be an even thousand. So, one claim of over a half a million produced a small frequency at 519,000 and 520,000 because it was actually between 519 and 520.

It would be better to do some smoothing on this, or use a continuous distribution, but I did not choose to do that because I would have had to explain to you how I did the smoothing, and you might or might not agree with the results. Also, it is very difficult to do this calculation with most continuous distributions. Most companies use discreet distributions for a lot of purposes, so it is not outside the range of standard practices.

The second random variable I call group variability. The concept here is that when we write a group, we do not know everything about it. We have groups that average, over the course of time, a much higher claim rate than our average group, and some average much lower. In fact, probably the less experience we have on the group, the less we know about it, which is shown in Table 3. The numbers in this table, as well as in the third random variable, relate to the variance. The square root of 1% is 10%, so if a random variable has a variance of 1%, it has a standard deviation of 10%, and therefore approximately 95% of the time, it will be within 20%. This strikes me as being a relatively high amount of variability, and I think that if we ignore it, we are simplifying the problem, and underestimating the amount of surplus we need. I got the numbers in Table 3 from some data that I had accumulated at Blue Cross, and at my current employer, Washington National. The model I used was based on the credibility of experience model that I developed in my *Transactions* paper on that subject (*TSA* XL, pp.387-404, 1988). I am not sure that those numbers should continue on down as the group size increases, and I did not have much data on very large groups. In any case, these are approximate estimates, but not as precise as the number of significant figures would imply.

The third random variable, which in a sense was the one that Bill Weller dealt with, is our inability to guess trend. I really did not have any data on which to base this

TABLE 2
Sample Discrete Distribution

u=1: Mean = 1.433, Variance = 28.175, Standard Deviation = 5.308

k	p(k)	k	p(k)	k	p(k)	k	p(k)
0	0.600839	43	0.000139	85	0.000023	131	0.000005
1	0.212998	44	0.000126	86	0.000019	132	0.000004
2	0.057230	45	0.000097	87	0.000023	133	0.000005
3	0.033316	46	0.000082	88	0.000015	134	0.000003
4	0.022218	47	0.000136	89	0.000005	135	0.000003
5	0.015504	48	0.000107	90	0.000011	136	0.000008
6	0.011139	49	0.000095	91	0.000017	137	0.000009
7	0.008179	50	0.000048	92	0.000018	138	0.000009
8	0.006329	51	0.000060	93	0.000009	139	0.000003
9	0.004906	52	0.000077	94	0.000004	140	0.000002
10	0.003751	53	0.000098	95	0.000006	142	0.000005
11	0.002734	54	0.000077	96	0.000015	145	0.000001
12	0.002257	55	0.000044	97	0.000007	146	0.000005
13	0.001984	56	0.000050	98	0.000021	147	0.000006
14	0.001629	57	0.000067	99	0.000014	148	0.000005
15	0.001230	58	0.000092	100	0.000005	150	0.000004
16	0.001179	59	0.000066	101	0.000013	151	0.000005
17	0.001041	60	0.000055	102	0.000015	152	0.000004
18	0.000854	61	0.000024	103	0.000015	153	0.000003
19	0.000741	62	0.000033	104	0.000012	158	0.000001
20	0.000633	63	0.000027	105	0.000011	159	0.000016
21	0.000554	64	0.000031	106	0.000003	160	0.000006
22	0.000529	65	0.000041	107	0.000004	169	0.000001
23	0.000528	66	0.000036	108	0.000007	170	0.000004
24	0.000485	67	0.000043	111	0.000002	172	0.000004
25	0.000397	68	0.000041	112	0.000007	173	0.000007
26	0.000387	69	0.000046	113	0.000005	185	0.000003
27	0.000352	70	0.000038	114	0.000007	186	0.000002
28	0.000403	71	0.000010	115	0.000006	197	0.000006
29	0.000333	72	0.000017	116	0.000001	202	0.000003
30	0.000306	73	0.000029	117	0.000009	203	0.000003
31	0.000253	74	0.000033	118	0.000002	204	0.000004
32	0.000258	75	0.000012	119	0.000005	205	0.000001
33	0.000245	76	0.000011	120	0.000004	206	0.000005
34	0.000228	77	0.000014	121	0.000005	245	0.000005
35	0.000204	78	0.000012	122	0.000010	263	0.000006
36	0.000231	79	0.000016	123	0.000004	285	0.000005
37	0.000193	80	0.000007	125	0.000002	292	0.000005
38	0.000172	81	0.000011	126	0.000003	323	0.000002
39	0.000177	82	0.000002	127	0.000005	324	0.000003
40	0.000133	83	0.000021	128	0.000013	519	0.000003
41	0.000121	84	0.000020	130	0.000005	520	0.000002
42	0.000136						

TABLE 3
Group Variances

Size	Years of Experience		
	0	1	2
50	23.9%	9.2%	5.1%
100	25.6	6.8	3.5
250	26.9	3.7	1.7
500	27.4	2.1	0.9
1,000	27.6	1.1	0.5
2,000	27.7	0.6	0.3

particular variable, and just out of feel, I used 0.09% for the variance, which might strike you as being small, but remember, this particular random variable will be fixed, selected once for the whole portfolio. No matter how large the company is, or how large the groups are, if that random variable is high enough then the company would be ruined. The standard deviation is 3%, so I am saying that we could guess trend in the coming year about 95% of the time, within 6%. For the last two random variables, I used a gamma distribution, only because it is more or less bell-shaped and relatively easy to calculate.

The results of the calculations appear in Tables 4-10. I did not do as many calculations as I would have liked. Table 4 shows the probability of ruin, assuming 10% margin plus surplus. That may seem a little low, so I did the same calculation at 15% in Table 5. Remember that margin here does not mean the refundable margin, but means the amount that we intend on keeping, and in a lot of cases, such as in groups that are experience rated, it is very seldom going to be more than 2-3%. Perhaps in the stock companies it would be a bit higher, so they can allow for the R factor.

TABLE 4
Probabilities of Ruin

Full Coverage
10% of Net Premium Safety (Margin Plus Surplus)
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	1.732%	1.303%	1.225%	1.119%	0.953%	1.406%
64,000	1.006	0.746	0.611	0.579	0.462	0.164
128,000	0.824	0.570	0.440	0.385	0.289	0.014
256,000	0.805	0.454	0.310	0.251	0.158	0.004
512,000	0.771	0.323	0.169	0.123	0.061	0.002

TABLE 5
Probabilites of Ruin

Full Coverage
15% of Net Premium Safety (Margin Plus Surplus)
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	0.116%	0.068%	0.058%	0.052%	0.036%	0.124%
64,000	0.031	0.015	0.011	0.010	0.006	0.005
128,000	0.012	0.007	0.005	0.004	0.002	0.000
256,000	0.011	0.006	0.003	0.002	0.001	0.000
512,000	0.012	0.005	0.002	0.001	0.000	0.000

If you look at the percentages, you will see that, as expected, they reduce as the size of the company gets bigger, and by the size of the company, I meant the number of insureds that are subject to the Table 2 probabilities of size of claim, which might be both employees and dependents (I did not allow for children, and used only an adult table). Perhaps there is more work that could be done on that aspect of it. As the size of the company gets bigger, the amount of surplus that you need reduces, but eventually, you get diminishing returns. The reason is, that with the third random variable, you never get the effect of the law of large numbers. No matter how big the company is, you are still subject to that risk at the same level.

As the group size gets larger, the probability of ruin tends to go down because the Table 3 variability reduces as the groups get larger. However, that is not always true, because the horizontal lines in the table represent the number of insureds, and as you move to the right, you obviously have fewer groups that make up the total. As the number of groups gets larger, there are more tradeoffs, where good groups tend to cancel out bad ones. It is not always clear, as you move from left to right on Table 4, which effect will predominate. In these two tables, I did show the answer to four decimal places and that probably was not good. I probably only have two significant figures in what I did.

Tables 6 and 7 show the same thing as Tables 4 and 5, except now I have calculated for a $25,000 specific stop-loss coverage. You will notice that the probabilities of ruin are considerably higher, which fits our preconceived notions. The program that I worked with does allow you to make any assumption you want about what the specific stop-loss level would be, or what the maximum claim retention would be if you bought reinsurance. Furthermore, I could have done a very similar calculation, assuming that you wrote aggregate stop loss, and it would have also been possible to do combined portfolios with different size groups, although I think those answers would be relatively close to the interpolated values in these tables.

Finally, there is the possibility of doing other products in this way, including the refund contract, which is one I really wanted to tackle, because I am not sure if it is more or

TABLE 6
Probabilities of Ruin

Specific Stop Loss at $25,000
10% of Net Premium Safety (Margin Plus Surplus)
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	21.301%	19.437%	19.168%	19.968%	18.524%	20.791%
64,000	17.171	17.096	16.841	17.800	16.081	16.677
128,000	13.548	13.458	14.359	14.210	13.500	14.234
256,000	11.167	11.606	12.076	11.844	11.689	12.571
512,000	10.206	10.386	11.017	11.017	10.841	11.632

TABLE 7
Probabilities of Ruin

Specific Stop Loss at $25,000
30% of Net Premium Safety (Margin Plus Surplus)
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	2.292%	1.993%	2.506%	2.587%	2.288%	2.713%
64,000	0.643	0.637	0.739	0.777	0.793	0.841
128,000	0.151	0.172	0.181	0.199	0.205	0.220
256,000	0.042	0.046	0.053	0.056	0.059	0.063
512,000	0.013	0.014	0.016	0.017	0.018	0.019

less risky than conventional insurance. That requires some assumption about the mix in your portfolio between groups at various stages of deficit, or that have built up funds that can be used to offset future deficits. I would still use the one-year approach, but I would make some assumption, either based on a known distribution of those deficits, or that based on an assumed distribution of probabilities of what they could have been. That means making some lapse assumptions, if you do the latter, as well as making some assumption as to what kind of risk charges you have been charging for the deficit risk alone.

Tables 8, 9, and 10 are essentially the same calculation, except I have illustrated what you would really want to do with this. In Table 8, I assumed a goal of 1% probability of ruin, and we see that the surplus requirements in this case are in the 8-12% range. The comparison between the products, the decision as to what to charge for margins, and how risky the products are, is really the goal of this.

Table 9 shows the same thing for a probability of ruin of 0.5%. Table 10 shows the same thing as Table 8, with a specific stop-loss level of $25,000, and once again we are seeing that surplus levels, instead of the 8-12%, are at the 19-38% level. I think that this sort of thing does illustrate the kinds of calculations that can be made. I do not have the actual formulas or the computer programs I used in doing this, but I would be happy to share that approach with anybody, if they would talk to me, and eventually I will publish it.

TABLE 8
Total Required Safety (Margin + Surplus)

Full Coverage
1.0% = Probability of Ruin
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	11.5%	10.8%	10.5%	10.4%	10.2%	10.9%
64,000	10.2	9.6	9.3	9.2	9.0	7.7
128,000	9.7	9.1	8.8	8.7	8.4	5.9
256,000	9.7	9.1	8.8	8.7	8.4	5.2
512,000	9.8	9.2	8.9	8.7	8.4	5.1

TABLE 9
Total Required Safety (Margin + Surplus)

Full Coverage
0.5% = Probability of Ruin
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	12.7%	12.0%	11.9%	11.7%	11.3%	12.4%
64,000	11.4	10.7	10.4	10.4	10.0	8.7
128,000	10.9	10.2	9.9	9.8	9.4	6.7
256,000	10.5	10.0	9.6	9.5	9.2	5.9
512,000	10.4	9.8	9.4	9.3	9.0	5.6

TABLE 10
Total Required Safety (Margin + Surplus)

Specific Stop Loss at $25,000
1.0% = Probability of Ruin
Group Variance Standard: One Year of Experience
Trend Variance = 0.09%

Size of Company	Group Size					
	50	100	250	500	1,000	2,000
32,000	36.3%	37.7%	38.6%	38.5%	37.5%	38.6%
64,000	28.3	28.6	29.3	29.1	29.0	30.1
128,000	23.3	23.5	24.1	23.8	24.3	24.2
256,000	20.3	20.5	20.7	20.9	21.1	21.3
512,000	19.1	19.2	19.4	19.6	19.6	19.8

MR. DAVID WILLIAM DICKSON: At Blue Cross/Blue Shield of Texas, we are using a very simplified method of determining what our surplus should be at any time, and that is no lower than three months of at-risk premium at the bottom of the cycle, and no more than five months premium at the top of the cycle. I was wondering, and this is a question for anybody on the panel, has the cycle been taken into consideration in any of your analysis or any of your regulatory dealings?

MR. WELLER: Yes, at one point in the advisory group review, the suggestion was made to vary risk factors within the cycle, with the feeling that the amount of surplus at the bottom of the cycle could probably be less, since you were expecting to come out of it. There was the feeling that very few regulators would buy that. So, we did not include any such variation.

MR. FUHRER: In the work I did, I used one year. It would be possible, probably, to extend that to a few years, and then assume that the third random variable had some sort of correlation from year to year, so that you could model the thing that you are suggesting. I am not sure, though, that I would really be very happy with that, as nobody has proven to me that there is much predictability to the underwriting cycle. When we are at the bottom of the cycle, do we really know we will come out of it in the next year, or in the next five? Right now everybody thinks we are starting on down, but I would be surprised if we hit another trough three years from now. I am confused as to how to work that in, and whether you really believe these cycles are quite as regular and predictable as your question would tend to indicate.

MR. DICKSON: We had our worst year of the down cycle in 1988. We got a call from the Texas State Board of Insurance in June 1989, and it wanted us to come in and talk, because the NAIC early-warning system had picked us up as somebody who ought to be looked at. Well, of course, the reason we have a cycle is because we have 12-month rate guarantees, we have a competitive situation, and we rate our groups 12-18 months ahead of time. By the time we got called in to the Texas State Board of Insurance, we had already taken the action that had helped us turn the corner, and we were positive again. On the downside, the cow could already be out of the barn before the State Board of Insurance ever called us in to take care of things. Then Mr. Snook would have to do his job. I hope the NAIC does something to help deal with the predictive value of the cycle because we are in the guarantee fund, and we help pay for each one of these small insurers that goes under.

MR. PETERSON: You are right. I personally feel that the cycle is self-made. Claims are always going up, and our premium levels are a result of the market environment. There are things that we do, and there are things that happen out there, such that you cannot look back three or six or nine years and say that is what is going to happen three years from now. I think the cycle represents an average of everything that is going on out there. I would not want to say that a particular company should have its minimum required surplus when the cycle gets down to the bottom; maybe that is the time it needs its largest amount of surplus. I can see why the NAIC were reluctant to go along with anything of that nature.

MR. DICKSON: They need to take a look at whatever rating actions the company has already taken, in determining whether the surplus is adequate or not.

MR. WELLER: Yes, that certainly has to be part of what happens if a company hits a trigger point.

MR. KERRY A. KRANTZ: I have an art question and a science question, and I will let the panel decide which is which. First of all, in determining your models, when you apply them, do you have any reasonableness tests, once you run them, to see whether the results make sense? And two, do you have any validity checks after actual experience emerges to see whether you want to refine your model and the assumptions you make?

MR. FUHRER: That is sort of a difficult question, because we are calculating a probability of something occurring, and, at least after one year, either it occurred or it did not, which does not really give us much data to go by. On the other hand, one of the nice things about statistics is that it is one of the few sciences for which we do get an opportunity to do validity testing. Some of the parameters that went into my model are subject to validity testing, both the claims size and frequency distribution, as well as the group variability. Particularly the former can be updated, and combined with and compared to the amount of variability we expect in our group business. The overall model probably is not subject to quite as much testing; it is more of a thinking model and a comparison model than one that is rigidly either wrong or right. We can gradually improve it, but we cannot really say exactly how good it is.

MR. WELLER: Certainly the NAIC is going to do a fair amount of testing, and we have two blocks of companies to test, those that experienced trouble or went insolvent, and those that are not experiencing trouble. It is hoped, as part of the test, that we will be able to show that the risk-based capital factors and those ratios do provide early warnings toward differentiating between those two. One of the problems with the current Insurance Regulatory Information System (IRIS) system is that it is creating a lot of "false positives" in terms of companies that come up to be reviewed, that do not really have problems. I think the other thing that it will be able to do for companies is to accentuate the trigger points which are likely to be in model regulation; they are not going to be hidden at all. Management will have a pretty good idea of which way its ratio is going and hopefully, management will take action long before the regulators have to, which is what we should all hope for.

MR. JOSEPH W. MORAN: A question for Bill Weller, with respect to the NAIC proposals. Is it anticipated that the NAIC document would specify a minimum with an instruction to the actuary that he should be responsible for determining whether the right number for a particular company's circumstances is larger than that, or is it to relieve the actuary of any professional obligation to make an independent evaluation of what he thinks is necessary?

MR. WELLER: The factor is to be calculated so that you can apply as a ratio, your actual capital surplus, plus MSVR, to this number. The actuary's responsibility is to have sufficient liabilities to recognize the company's liabilities, so that they have the appropriate amount not included in capital and surplus, but in the liabilities of the company, to handle the assumed level that the company has. This will provide for variation from what might be an appropriate risk. These would not be varied by the actuary.

MR. MORAN: The thing that concerns me is that it implies that where there is a particular type of risk exposure in a given company that has a higher degree of uncertainty as to the future volatility of claims, that company would be expected to deal with that uncertainty by establishing additional liabilities, rather than holding additional surplus, even though it is only the uncertainty that it is to provide for. It sounds to me like it is coming out backwards, if you put it in liabilities rather than in surplus.

MR. WELLER: Risk-based capital is not meant to be defined as the amount of capital in surplus that a company is to hold. It is an indicative value based upon fairly broad generalizations from which regulators can have a quantitative factor to determine when still-to-be-defined appropriate actions should be taken. I think a company has a right to decide if it has higher risks, and if the actuary and management can agree on a higher level of surplus, certainly they should hold that. If they feel that they have less risks, and they want to hold less, and they are willing to deal with the regulatory effects of that, they can do that. In fact, management can probably do it without the actuary.

MR. PETERSON: That is probably one of the problems we see now with Best's and certainly with S&P and perhaps as well with Moody's, where they are working with leverage ratios. If you are a conservative company with very redundant, conservative reserves, then you are supposed to have more surplus. It seems to work against itself. Raise your hand if your company is rated by Moody's or S&P? That is probably well over half. Raise your hand if your company is not rated by either Moody's or S&P? Probably somewhat less than half. As you know, what S&P has done, is assign claim paying ratings, ranging from AAA down to C, to about 400 companies at a price of $25,000 per year, give or take a few dollars. And then, for the other 1,600 or so companies which chose not to secure such a rating, it decided to rate them anyway based upon its convention blank. They will either be qualified as a triple B company, a double B company, or a single B company. I think they have about 15% of the companies in the top and 15% of the companies in the bottom, and the other 70% of the companies in the middle. But the letters they chose to assign to those companies were BBBQ, BBQ, and BQ, so these 1,600 companies in no way, shape or form can be compared with a single, double, or triple A company. The big question is, How do you become an A category company rather than a B category with S&P? The answer is you pay them the $25,000.

It has long been my feeling that companies that specialize in and emphasize the health insurance business are shortchanged in dealing with the rating agencies. To become an A+ company with A.M. Best, you have to have nearly a dollar of surplus for every dollar of premium, unless you are an extremely large writer of health insurance. With S&P, it's pretty much the same type of ball game. You have to have one third or more of your premium represented by your surplus account, and sometimes they add reserves on top of the premium. Again, when you are conservative and have some contingency reserves above the line, you pay the price with the rating agencies. The difficulties of the companies having financial problems are on the asset side of the balance sheet, very often related to annuities, guaranteed investment contracts, and some of the interest-sensitive pressures of the universal-life-type products; but it looks as though the health insurers are going to be suffering, finding it even more difficult to get a respectable rating.