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MANAGING THE BOTTOM LINE -- GROUP EXCLUDING MULTIPLE EMPLOYER TRUSTS (METs)

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Recorder: CHARLES S. FUHRER

- Underwriting techniques
  - --- New business
  - -- Renewals
- Claim controls
- Management reports
- Alternate funding arrangements
- Rate manual testing
- Evaluating
- Pricing considerations
- Reinsurance
- Underwriting cycle
- Sales control

MR. CHARLES S. FUHRER: We have for you four unrelated talks by three of us! I'm going to be doing two of them. We could talk about almost anything we wanted, as long as it was on group insurance.

The first talk is by Tim Lee, who has worked for the last 13 years for Milliman Robertson in Houston. He's doing consulting in group health insurance, mostly for insurance companies, but also for HMOs, self-funded plans and health and welfare plans. He's also President of the Actuaries Club of the Southwest. He's going to talk about managing the bottom line through financial projections, which relates to the evaluating and management report sections of the program.

I'm going to do the second talk. My topic covers some ways to calculate reserves. I'm currently and have been for almost five years, actuary at Blue Cross/Blue Shield of Illinois, Health Care Service Corporation.

The third talk will be by Jim Drennan. Jim works for Tillinghast in St. Louis. He is also doing consulting in group health insurance to insurance companies and Blue Cross/Blue Shield plans. Before that he worked four years with the Blue Cross/Blue Shield plan of Louisiana in Baton Rouge and about 10 years for the Philadelphia Life Insurance Company. He's originally from Texas. His talk will be on claim controls and management reports, within the managed care environment. This includes measuring utilization controls and cost controls.

I'm going to be doing the fourth talk about renewal underwriting and rating. In particular I will discuss the calculation based on a paper that I wrote that was published in the *Transactions*, Volume XL (1989).

MR. TIMOTHY D. LEE: I intend to talk about the reasons for doing a financial prosection and the uses for such projections. We will also talk about the characteristics of group health business that make such projections difficult to do, but at the same time make the projections imperative. We will talk about the actual mechanics of doing a financial projection, and I will talk about some new approaches that my company is taking that allow us to do a better and quicker job, particularly on the revenue side.

I am constantly amazed in our consulting assignments at how little financial projection work seems to be taking place in group health companies. I suppose part of the reason for this is that there is a lack of appreciation of the value of and uses for a good financial projection. However, part of the reason is probably a very practical reason, which is that group departments, and the group actuary in particular, are probably just too busy with day to day operations to worry about doing special time-consuming projects such as financial projections. Nevertheless a group actuary should know how to do financial projections and should find a way to do them on a periodic basis. I have concluded that a good financial projection is perhaps the most critical tool for use in managing group health business. A good projection is somewhat difficult to do, and it can be time-consuming to do it right. However, with good claim data reports, which should be available anyway for other uses, and with the imaginative use of current PC technology and database software, we now have the ability to produce financial projections easier and better than ever before.

Why do financial projections for group health? A good reason for doing financial projections is that good upper management will demand such projections. Good management will be asking such questions as:

- Are we making money or losing money in our group health business, and why?
- How are our financial results varying from what we had projected they would be, and what are the reasons for such variance?
- Are we going to make money or lose money in the future, and why?

Whether upper management is demanding projections or not, management needs financial projections to make strategic decisions for the group health line of business and for the company. Let's review some of the areas in which management is going to be setting company direction and strategy:

- Pricing -- Obviously, decisions continually need to be made regarding premium rate levels, including underlying trend assumptions and profit loads. Pricing decisions will be made with due regard to the marketplace and the competition, however financial projections are also a necessary part of the process. You really need to know what level of gain or loss current rate levels are likely to produce, and that usually cannot be determined from just looking at past financial results.

- Surplus Management -- A company can use financial projections to manage its surplus in relation to its risk and anticipate future surplus needs. Is surplus

adequate for the risk assumed? Is surplus adequate to support the writing of new business? Does the company need to be making plans for capital infusions, surplus debentures or reinsurance to strengthen surplus?

- Entering New Product Lines -- Will the financial resources be available to support the cost of entering a new market? Will the profit potential of new products exceed or fall short of the profit in the existing products?

- Exiting Existing Product Lines -- Do anticipated financial results make continuance of certain product lines unacceptable?

- Staffing of the Organization -- Certain staffing activity might be postponed or accelerated, depending upon anticipated financial results.

- Negotiating with Healthcare Providers -- Negotiations will be influenced by expectations of financial results. High expectations may allow you to be more generous. Low expectations suggest you may need to drive a hard bargain.

- Managing General Expenses -- This item includes agent compensation programs. The internal budgeting process, which is a component of financial projections, may reveal areas in which general expenses are excessive.

- Investing Assets -- Projected cash needs will drive investment decisions. Should you invest short or long? What is the cash position projected to be? Will liquidity be important?

- Acquiring Other Companies or Blocks of Business, or Sale of Company's Own Block of Group Business -- These are not routine occurrences, but if they ever do come up, financial projections will be an inherent part of the process of evaluating a company or block of business.

Again, I want to say that these are all areas in which financial projections can aid top management in its strategic planning, and if management is not demanding financial projections, it should be.

Whether or not upper management is demanding a projection, the group actuary should periodically do one anyway for internal group department use. Such projections, and the resulting tracking of financial experience for comparison purposes, can substitute some facts for appearances relating to certain product lines that you may just as soon not be in, but for which marketing has convinced upper management that you should be in. Sitting down and doing a projection also forces you to at least think about certain lines of business that you really tend to ignore, such as the group term life and the short-term disability.

CHARACTERISTICS OF GROUP HEALTH BUSINESS

Let's consider the financial characteristics of group health business that make financial projections so important. This is an extremely challenging business. It is a business in which the cost of the product which you sell, your cost of goods, is increasing rapidly,

probably at a rate of about 20% per year. At the same time, the market price that you put on your product is also increasing rapidly and erratically. Over the long term the price is going up at about the same rate as the cost. However, for a variety of reasons, for any particular year the price may only go up half as much as the cost, or it may go up twice as much as the cost.

Another characteristic of this business is that target profit margins are quite small, usually less than 5% of revenue.

As a result of these three characteristics, actual profit tends to fluctuate significantly from year to year, is difficult to measure, and is difficult to predict.

In the life insurance business we actuaries like to joke that, by the time anyone figures out whether we were right or wrong in our assumptions, we are probably all dead anyway. However, unlike the life insurance business, the actual profit results on group health business are known relatively quickly, usually within six to nine months after the close of the financial reporting period. Still if you told the presidents of most industrial organizations in this country that they would have to wait nine months after the end of their financial reporting period before they could get a reasonable idea of what their gain or loss position was for the period, they would probably not believe you, and they would wonder how anyone could possibly manage a business in such an environment.

A key problem facing the group actuary is the lag time involved in determining the actual cost of the product that you sell. Let's consider the case of experience-rated groups first.

Consider a group with a July 1, 1990 renewal date that requires a rate quote three months in advance of the renewal date, or at April 1, 1990. It is the company's practice to use the most recent 12-month experience period as the base for the rate calculation and to guarantee premium rates for one year. In this example, calendar year 1989 is the base experience period for which, by April 1990, probably over 95% of the incurred claims have been paid. The incurred claims from the experience period will be trended forward 18 months from the midpoint of the experience period to the midpoint of the rate guarantee period. This will represent the company's estimated cost of its product for the 12 months ending July 1, 1991, and will form the basis for the price the company will put on its product. The actual cost of the product will not be known until about October 1, 1991.

The period of time over which incurred claims must be trended (18 months in this example) creates a possibility for substantial error in estimating incurred claim costs for the rate guarantee period. It is not surprising then that pricing of group health products often gets out of sync with the cost of the product, resulting in a financial outcome much different from the target profit margin.

A somewhat more extreme example occurs for manually rated groups. For manually rated groups, the company will have a rate manual with certain base claim costs that have been derived from previous experience. In this example, the same 1989 experience period might be used to derive base premium rates for a rate manual that becomes

effective for groups renewing July 1, 1990 and later. If the 18-month trend factor applied to the 1989 incurred claims is inappropriate, then the base premium rates in the manual rate book will be inappropriate. Even if the trend factor that is then applied to those base rates in the rate development is correct, the resulting premium rates will be wrong.

If the company looks at its claims experience once a year to update its rate manual, then groups quoted as late as June 30, 1991, will be on a rate manual based upon assumptions in effect at April 1990. With a one-year rate guarantee, we can see that the rating decision that was made in April 1990 will continue to impact the company's financial results through June 1992. This lingering effect of past mistakes is responsible for so much of the risk present in group health business and is what makes periodic financial projections so important.

As you might expect as consultants we are often called upon by companies when things are not going quite so well. A typical case would be at the end of a calendar year when a company realizes that it has not had a good year in its group business. We may be called in and asked what we can do to help the company improve its financial results for its current calendar year. At that point we have to tell the company to forget about the current calendar year -- that's virtually a "done deal." Let's talk about what you can do to improve financial results for the calendar year after next. Many managements (but not the actuaries) are surprised to learn how much of their premium for the next calendar year has already been determined through prior rate quotes. Since they cannot really do anything about the claim level that will be incurred, except to pay the claims, that means the financial result for the next 12 months at any point in time are essentially pre-ordained and can only be very limitedly affected by any future rating action. For example, for a stable block of business with no new groups and no lapsing groups, a uniform distribution of renewal dates by month (all on the first of the month), and a three-month lead on rate quotes with a 12-month rate guarantee period, the percentage of 1990's premium revenues that can still be influenced by decisions made after December 31, 1989 is 31%. If the distribution of renewal dates is skewed toward January, which most are, the percentage can be much less, even less than 15%.

Again this is the situation that creates the uncertainty in the group health line of business. I believe the solution to this uncertainty is to produce periodic financial projections of the business. It should be an ongoing process that consists of:

- Projecting financial results
- Monitoring actual experience
- Updating assumptions
- Adjusting premium rates
- Reprojecting financial results

CHARACTERISTICS OF GROUP HEALTH FINANCIAL PROJECTIONS

The layout of a financial projection should be essentially a summary of operations, with income items consisting of premium revenue, other revenue (e.g., ASO fees), and investment income. Outgo should consist of claims expenses, commissions, allocated general expenses, and premium taxes. Net income would normally be on a before federal income tax basis, although for surplus management purposes, you may want to adjust company-wide projections for federal income taxes as a last step.

It may not be possible for the group actuary to make a specific allocation of general expenses by line of business, and this may not be too important for this financial projection. However, the actuary should certainly know, from prior general expense analysis, what the appropriate target loss ratios are for each of the group lines of business.

In doing financial projections, the group business should be divided by line of business and by rating cell within line of business. The usual lines of business are medical, disability, life and AD&D. Within the medical line of business, the following rating cells should be projected separately:

- Association group
- Small group
- Pooled group
- Experience refund
- Stop-loss reinsurance
- Administrative services only
- Group conversion.

The disability line of business would likely be split between short-term disability and long-term disability, and the life insurance business should be split between group term life and group permanent life. The splits by rating cells are very important if the full value of the financial projection is to be achieved; that is, if it is to become a tool for management in making management decisions about specifically needed rate actions or getting into or out of a subline of business.

We prefer to do projections on a monthly basis, although we realize that seasonality and fluctuation in claim costs can make monthly comparisons of projected profits with actual profits of limited value. However, the value of the monthly projection is that it shows the impact on revenues of the nonuniform distribution of groups by renewal date. That is, when jumbo groups renew, or at certain months such as January or July that may be common renewal months for a large portion of the company's business, in monthly projections the revenue impact of prior rating decisions is clearly shown. For example, we may see a very sharp increase in premium revenue from December to January and then slow monthly increases after that. By nailing down the premium revenues on a monthly basis, you are faced only with analyzing the claims to judge how much seasonality or fluctuation played a part in actual profit results varying from projected.

We believe that a 24- to 26-month projection period is probably the optimal period. You need to go out about 24 months to really see the full impact of rating decisions that you will be making over the next 12 months. However, a projection period that extends beyond 36 months is of limited value with respect to day to day management decisions regarding group medical insurance.

Sometimes the cash projection is a useful companion to the normal projection on an accrued basis, particularly if the company is experiencing cash-flow problems or if the company is looking for sources of cash to use for other ventures.

CLAIM COST ANALYSIS AND PROJECTION

Any gain and loss report, at the time it is done, is only an estimate of the actual gain and loss for the period in question. It is only an estimate because the incurred claims are only an estimate through the use of the change in the beginning-of-year and end-of-year claim reserve. In analyzing past claims experience, the first step for the actuary is to go back to prior gain/loss reports and adjust the incurred claims and reported gains and losses to reflect the actual claim runout that has occurred. To do this, all you need is a claim lag report which is a summary of monthly paid claims sorted by incurral month.

The actuary's original estimate of the end-of-year claim reserve in financial reports tends to become "written in stone" as it is reported within and outside the company. However, for purposes of internal reporting for the group department, the group actuary should look back at the actual claim runout since the reporting period and restate the claim reserves and gains and losses as appropriate.

This restatement can often put a different light on the financial performance of the group department, especially given the cyclical nature of the business that will influence rating actions and other management decisions. Let's look at an actual example. This is a company that we began working with in 1987. We were called in to review the operations of the group department and to advise it on its rating strategies. The group department did quarterly financial reports for management in the form of a summary of operations. At the time, 1986 financial results had just been reported and those results had been surprisingly bad. Table 1 shows the reported financial results which management was seeing for calendar years 1984, 1985, and 1986. As you can see by looking at the results in 1984 and 1985, it appears that things were getting better for the group department. Then came 1986, when apparently the bottom fell out. Who could have possibly seen this coming?

TABLE 1
ABC Group Company Group Medical Gain/Loss

Year	Booked Claim Reserves			
	Beg. of Year	End of Year	Change	Booked Gain/Loss
1984	$ 8,595,000	$ 9,515,000	$ 920,000	$ 1,976,000
1985	9,515,000	10,875,000	1,360,000	3,128,000
1986	10,875,000	10,645,000	(230,000)	1,008,000

Let's look at what could have been done had the group department had a practice of recasting past claim reserve estimates and recasting earnings. In Table 2 we show the actual claim liability determined as a result of actual claim runout and the implied earnings. As you can see, 1984 still looks pretty good. However, there is a significant deterioration in the financial results in 1985. Consequently, the 1986 financial results, contrary to being an unpredictable fluctuation, now clearly make sense. The frustrating thing about this situation is that the 1984 and 1985 financial experience could have been known with a high degree of certainty by the second quarter of 1986. As I have discussed earlier regarding the long lag time involved in having premium rate

TABLE 2

ABC Group Company
Group Medical Gain/Loss

Year	Booked Claim Reserves			Booked Gain/ Loss	Recast Claim Reserves			Recast Gain/ Loss
	Beginning Of Year	End Of Year	Change		Beginning Of Year	End Of Year	Change	
1984	$ 8,595,000	$ 9,515,000	$ 920,000	$ 1,976,000	$ 7,205,000	$ 7,600,000	$ 395,000	$ 2,501,000
1985	9,515,000	10,875,000	1,360,000	3,128,000	7,600,000	10,310,000	2,710,000	1,778,000
1986	10,875,000	10,645,000	(230,000)	1,008,000	10,310,000	10,500,000	190,000	588,000

adjustments impact financial results, the second quarter of 1986 would still be too late to do anything material about the 1986 financial results. However, management could have started acting with the appropriate rate adjustments at that time instead of waiting until 1987 when the 1986 poor results are finally known.

Another reason to recast reserves and earnings is that sometimes claim reserves are used by management to manage (I won't say manipulate) income. So, in addition to the constant risk of reserve misstatement by the actuary, income can also be distorted by explicit management decisions regarding the level of the claim reserve.

Now that we have restated past earnings to a correct basis, we can move ahead with our analysis of the past claims experience. When we analyze claims experience for projection purposes, we tend not to look at past loss ratios since the cost of claims is independent of premium revenue. We like to look at the claim cost per unit of exposure, with the unit of exposure usually being an employee or a contract. For an HMO, units of exposure might be members. In our minds, good exposure data are the second most important data, next to a claim lag report, used in managing a group health line of business.

We look at incurred claims per exposure unit (denoted "Pure Premium" in Table 3) on a monthly basis. So as to smooth out the fluctuations on a month to month basis, we also look at 3-month and 12-month moving averages. With careful and appropriate claim reserving techniques we can develop an estimate of the incurred claims in recent months to complete this analysis and develop an incurred claims per employee per month number which can be used as the starting point in our claims cost projection.

Now that we have incurred claims per employee, we can start analyzing the trends in that measurement. In Table 3, we can see that it is also helpful to do a 3-month and 12-month moving average on the trend numbers. While the 12-month moving average results in the smoothest trend pattern, the 3-month moving average is also helpful in picking up recent changes in trend direction (that is, the second derivative).

The trends in the incurred claims per employee that we observe will reflect several influences:

- medical cost inflation
- utilization trend
- intensity of services trend
- cost shifting from Medicare, Medicaid and managed care programs
- wearing off of underwriting selection
- adverse selection from past rate increases
- HMO penetration
- expansion of mandated benefits
- changes in mix of: benefit plan (such as movement to higher deductibles), age, sex, family status (single, married, married with children), and geographical area.

When we make our selection of the trend assumption to apply to our claim cost assumption, we have to consider the extent to which we expect these factors to influence the

ABC GROUP INSURANCE COMPANY

TRENDS IN PURE PREMIUM
BASED ON CLAIMS PAID DURING 6/86 TO 7/89
INCURRED THROUGH 7/89

JULY 31, 1989 VALUATION
GROUP MAJOR MEDICAL

SCALING UNIT: $1
EXPOSURE OPTION: NO CHG

RESERVING CELL LEVEL ONE: 01
RESERVING CELL LEVEL TWO:
RESERVING CELL LEVEL THREE:
RESERVING CELL LEVEL FOUR:

COMPLETION BASE: 1 MONTH
COMPLETION METHOD: MULTIPLICATIVE WITH 6 MONTH AVERAGING
RECENT 0 MONTH METHOD: NONE

ENDING	EXPOSURE			ESTIMATED INCURRED			PURE PREMIUM			ANNUALIZED TRENDS		
MONTH	1 MONTH	3 MONTH	12 MONTH	1 MONTH	3 MONTH	12 MONTH	1 MONTH	3 MONTH	12 MONTH	1 MONTH	3 MONTH	12 MONTH
6/86	47407			4597919			96.988					
7/86	48215			5080780			105.378					
8/86	49025	144647		4109013	13787712		83.815	95.320				
9/86	49834	147074		4556326	13746119		91.430	93.464				
10/86	50327	149186		5017272	13682611		99.693	91.715				
11/86	50821	150982		4422768	13996366		87.026	92.702				
12/86	51314	152462		4463088	13903128		86.976	91.191				
1/87	52052	154187		5588194	14474050		107.358	93.873				
2/87	52792	156158		4671422	14722704		88.487	94.281				
3/87	53530	158374		5733343	15992959		107.105	100.982				
4/87	53919	160241		4935249	15340014		91.531	95.731				
5/87	54306	161755	613542	5563456	16232048	58738830	102.446	100.350	95.737			
6/87	54695	162920	620830	5170204	15668909	59311115	94.528	96.175	95.535	0.975		
7/87	55153	164154	627768	5937741	16671401	60168076	107.659	101.560	95.844	1.022		
8/87	55612	165460	634355	5695758	16803703	61754821	102.420	101.557	97.351	1.222	1.065	
9/87	56070	166835	640591	5364539	16998038	62563034	95.676	101.885	97.665	1.046	1.090	
10/87	55871	167553	646135	5833022	16893319	63378784	104.402	100.824	98.089	1.047	1.099	
11/87	55673	167614	650987	5372234	16569795	64328250	96.496	98.857	98.816	1.109	1.066	
12/87	55474	167018	655147	5347865	16553121	65213027	96.403	99.110	99.540	1.108	1.087	
1/88	55567	166714	658662	6591994	17312093	66216827	118.631	103.843	100.532	1.105	1.106	
2/88	55659	166700	661529	6177464	18117323	67722869	110.988	108.682	102.373	1.254	1.153	
3/88	55752	166978	663751	7186995	19956453	69176521	128.910	119.515	104.221	1.204	1.184	
4/88	55407	166818	665239	6380407	19744866	70621679	115.155	118.362	106.160	1.258	1.236	
5/88	55062	166221	665995	6906105	20473507	71964328	125.424	123.170	108.055	1.224	1.227	1.129
6/88	54717	165186	666017	6368714	19655226	73162838	116.394	118.988	109.851	1.231	1.237	1.150
7/88	54508	164287	665372	6023291	19298110	73248388	110.503	117.466	110.086	1.026	1.157	1.149
8/88	54300	163525	664060	6879532	19271537	74432162	126.695	117.851	112.087	1.237	1.160	1.151
9/88	54090	162898	662080	6088755	18991578	75156378	112.567	116.586	113.516	1.177	1.144	1.162
10/88	53957	162347	660166	6656634	19624921	75979990	123.369	120.883	115.092	1.182	1.199	1.173
11/88	53825	161872	658318	6739626	19485015	77347382	125.214	120.373	117.492	1.298	1.218	1.189
12/88	53691	161473	656535	5650950	19047210	77650467	105.249	117.959	118.273	1.092	1.190	1.188
1/89	53681	161197	654649	7113343	19503919	78171816	132.511	120.994	119.410	1.117	1.165	1.188
2/89	53672	161044	652662	6193251	18957544	78187603	115.391	117.717	119.798	1.040	1.083	1.170
3/89	53663	161016	650573	6422813	19729407	77423421	119.688	122.531	119.008	0.928	1.025	1.142
4/89	53313	160648	648479	6412709	19028773	77455723	120.284	118.450	119.442	1.045	1.001	1.125
5/89	52962	159938	646379	6305880	19141402	76855498	119.064	119.680	118.902	0.949	0.972	1.100
6/89	52612	158887	644274	6328142	19046731	76814926	120.279	119.876	119.227	1.033	1.007	1.085
7/89	52342	157916	642108	6249769	18883791	77041404	119.403	119.581	119.982	1.081	1.018	1.090

trend in the future. It is desirable to anticipate changes in trends. For example, Milliman & Robertson's Health Insurance Trend Model tracks past trends and uses certain economic indicators to project future changes in the trend under various scenarios. These economic indicators include:

- the CPI-W (less energy components)
- inpatient days per 1,000
- inpatient length of stay
- Medicare payments per inpatient hospital day
- hospital payroll expenses per full-time equivalent.

We apply the chosen trend factors to the incurred-claims-per-employee assumptions to project incurred claims over the 24- to 26-month projection period. Next, we can apply the enrollment projection, if we believe enrollment is going to change, to the incurred-claims-per-employee numbers to get the total projected incurred claims by month.

PREMIUM REVENUE

This is the item that is really the most challenging of all the components of a group health financial projection. Some of the reasons that premium revenue is difficult to project are that:

- every group has a different premium rate per employee due to the age and sex mix, benefit plan differences or renewal date;

- the distribution of employees by renewal month is not uniform; and

- special rate adjustments are sometimes made by marketing or underwriting personnel.

It is a fairly easy task to determine the company's current premium revenue per employee. You simply look at the earned premiums for the current month divided by the number of employees insured. However, the difficult part is projecting how that per employee revenue number will increase in the future. It is not enough to simply know the underlying trend assumption used in the rating process.

As an extreme example, assume that all groups were sold and renew with a 12-month rate guarantee in the month of January. Clearly, the company will see step-rated increases in its per employee premium revenue every January. From January through December there would be no increase in the revenue per employee. This situation would be important to know and to factor into any financial projection of the business. Since claim costs would be expected to be increasing at a fairly consistent rate from month to month, a company with all January renewals would expect to make considerably more money in the first six months of the calendar year immediately following a rate increase than it would in the latter six months of the calendar year.

Assume that the renewal dates of all the company's groups are uniformly distributed across all calendar months and that the underlying premium trend used in the rating process exactly matches the underlying claim cost trend. In this situation the company would expect constant loss ratios over time, ignoring month-to-month claim fluctuations.

In projecting the premium revenue per employee, the group actuary needs to reflect the distribution of renewal dates by month and the different rate increases that may be affecting different renewal months. This is not an easy task and usually results in some modelling and approximation to make it manageable. Very large groups might be separated from the rest of the business so that their rate increases may be reflected in the exact amount and month in which they occur. The distribution of in-force premium revenue can be determined for the remaining groups resulting in an assumption something like 20% of premium in-force renews in January, 8% renews in February, 7% renews in March, etc. Since the underlying premium trend should be known (assume it is 18% per year), the actuary can say that, in January, 20% of the premium will get an 18% increase, or premium will increase 3.6%. In February, another 8% of the premium revenue will get an 18% increase, or an aggregate increase of 1.44%.

A problem with this approach is that the distribution of premium revenue by renewal month is very likely not available nor is it easily attainable in most group departments. I would like to tell you about the approach that we have taken to the entire premium revenue projection issue. We have found that database software on our PCs can be a powerful tool for group health revenue projections. The system that I am going to describe was set up and is operational for a group health client with about 800 groups and $80 million of premium in force.

What we do is set up a file on the database for each separate group that is in force. The file will contain various data, at each group's renewal date, file is updated as appropriate.

The first screen (Table 4) is a layout of general information on the group. We have included enough information to be able to sort the group by rating cell. Such determinants include a plan code, an indication as to whether the group is experience rated or pooled, the renewal date, the geographical area, and an industry code. With this information, the actuary working with the computer can very easily call up all groups with an April renewal date, for example, or all groups with an April renewal date under a particular plan in a particular zip code, or any combination of these key indicators.

TABLE 4

Group Information

Group Number: 088801
Group Name: Bubba's Putt-putt
Address: 12345 Old Llano Road
City: Fredericksburg State: TX Zip: 78624
SIC Code: 123.45
Original Effective Date: 4/1/85
[E]xperience Rated or [P]ool: P
Plan Code: IP
Tier Structure Code: 4
Last Anniversary Date: 4/1/89 Next Anniversary Date: 4/1/90

This database can be used for many purposes, but for financial projection purposes, the anniversary date turns out to be the key indicator for sorting groups. The next screen (Table 5) in this group's file is a record of the number of contracts in force by type of contract. In this example, we have four single contracts, one couple, one one-parent family and six two-parent family contracts. We also have a field for the expected number of contracts as of the next anniversary date for which the marketing department is responsible for estimating. This information would be used in our financial projection when we project the number of contracts beyond the next anniversary date.

TABLE 5

Contract Information

		Total Contracts Last Anniversary: 4/1/89	Expected Total Contracts Next Anniversary: 4/1/90
Type:	Single	EES: 4	EES: 4
Type:	Couple	EES: 1	EES: 1
Type:	1 Par/Child (Ren)	EES: 1	EES: 1
Type:	Full Family	EES: 6	EES: 6

Expected total contracts defaulted to current total contracts: Y

The next screen (Table 6) in our database records dependent enrollment information by contract. We record the number of spouses and the number of children under each contract type. The next screen (Table 7) includes premium rate information on this group. We record the premium rates that were effective at the last anniversary date by contract type, and we record the premium rates that will be in place at the next anniversary date, if they are known. If the next anniversary premium rates are not known, the system will default to the current premium rates times the current premium trend factor. This screen is updated by a clerk at the time that renewal rate quotes are made, usually two to three months in advance of the renewal date. At that time the clerk knows the actual premium rates, and they can be used to override the default calculated rates.

TABLE 6

Membership Information

Total members at last anniversary: 4/1/89

Type:	Single	EES: 4	SPS: 0	CHS: 0
Type:	Couple	EES: 1	SPS: 1	CHS:
Type:	1 Par/Child (Ren)	EES: 1	SPS: 0	CHS: 2
Type:	Full Family	EES: 6	SPS: 6	CHS: 14

SEMINAR FORMAT

TABLE 7

Premium Rate Information

ACR Factor: 1.0000 Age/Sex Factor: 1.8420 Industry class factor: 1.8900

Current rates effective date: 4/1/89			Expected rates for: 4/1/90 (Default=Trend* Current Rates) Trend: 1.14	
Type: Single	Rate:	$90.05	Rate:	$102.66
Type: Couple	Rate:	240.30	Rate:	273.94
Type: 1 Par/Child (Ren)	Rate:	158.34	Rate:	180.51
Type: Full Family	Rate:	289.56	Rate:	330.10

Rates are equal to the default: Y

Other information that can be included in the database for each group, but which is not necessary for the premium projection includes:

- a census of the employees by age and sex,
- the volume discount factor used in rating,
- finer plan distinctions (e.g., deductible level, type of psychiatric benefits, PPO or non-PPO, etc.),
- the HMO penetration rate into the group,
- the agent who sold the business, and
- the discretionary load or discount applied by the underwriter.

In other words, almost anything could be included in such a database for which you would want to be able to analyze. The key is to have a routine setup, probably in the underwriting department, in which a staff person would routinely update the database on each group, probably once a year at the time of renewal. This should be a very manageable task for the underwriting department and in fact can probably serve as a substitute for many of the data-gathering tasks it is currently performing.

Once the data have been captured in the database, it is a fairly trivial process to write the computer program to calculate the monthly premium revenue for each group, sort the groups by renewal month, sum up the total premium for all groups by renewal month, and finally to project total premium revenues for the group line of business. We have three reports which show the results of this work. The first report (Table 8) shows that the groups have been sorted by renewal month and the monthly premium of each group has been calculated by multiplying the employee contract counts times the premium rates for each contract type that exists in the database. Monthly premiums have been calculated for each group as of the last anniversary date and as of the next anniversary date. The total monthly premium for the anniversary month, and the anniversary month one year later is found by summing over all the groups. In this example, the total monthly premium in force on October 1988 renewals is $161,264.70. That premium will increase to $183,840.41 in October 1989, which reflects the expected rate increase plus any enrollment changes anticipated by marketing.

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

TABLE 8

Premium Projection by Anniversary Month

Anniv. Month	Group	Group Name	Anniv. Month's Premium	Projected Premium (Next Year)
Oct 1, 1988	000901		$10,974.79	$12,511.35
	012301		$496.84	$566.39
	012701		$1,283.38	$1,463.04
	012801		$5,069.96	$5,779.71
	012901		$670.46	$764.31
	013001		$3,690.27	$4,206.87
	021301		$5,171.52	$5,895.52
	021401		$1,529.29	$1,743.39
	021601		$1,355.67	$1,545.47
	021801		$2,648.55	$3,019.35
	022001		$2,301.31	$2,623.51
	022101		$2,774.13	$3,162.53
	022201		$55,249.65	$62,983.40
	022202		$143.78	$163.90
	034401		$1,611.61	$1,837.22
	035401		$8,655.35	$9,867.08
	035402		$5,091.23	$5,804.00
	035403		$280.24	$319.47
	035404		$6,772.32	$7,720.39
	035405		$3,756.82	$4,282.76
	035406		$1,067.05	$1,216.43
	035407		$90.06	$102.67
	035408		$180.12	$205.34
	044201		$1,012.20	$1,153.91
	044401		$6,647.98	$7,578.69
	044402		$537.92	$613.23
	044501		$1,003.54	$1,144.03
	044601		$2,805.98	$3,198.81
	044602		$413.12	$470.96
	044701		$1,813.74	$2,067.64
	044801		$1,466.50	$1,671.80
	045001		$1,389.43	$1,583.95
	045101		$712.72	$812.49
	045301		$651.69	$742.91
	053301		$1,111.27	$1,266.83
	053401		$1,433.74	$1,634.45
	053501		$1,143.28	$1,303.33
	053601		$7,592.93	$8,655.88
	053701		$8,238.06	$9,391.55
	053702		$276.95	$315.72
	053801		$1,230.09	$1,402.29
	053901		$919.16	$1,047.84
M T:			$161,264.70	$183,840.41
Nov 1, 1988	007501		$45,826.33	$52,240.93
	007502		$1,055.27	$1,202.99
	013101		$6,191.01	$7,057.84
	013301		$1,616.10	$1,842.35
	013401		$265.23	$302.37
	022401		$1,891.28	$2,156.08
	022501		$2,957.02	$3,370.97
	022502		$236.41	$269.51
	022601		$1,403.71	$1,600.21

The next report (Table 9) summarizes the total monthly premium determined for each renewal month.

The third report (Table 10) is the actual projection in which the total premium from each renewal month is summed over rolling 12-month periods to get the total premium in force during each month of the projection period. For projection months beyond the end of the next renewal year, we would simply trend the premium from the previous anniversary month at the underlying premium trend rate.

This premium projection would be done for each rating cell such as small group, pooled groups, etc. This differentiation is accomplished through making the appropriate sorts in the database before running the calculation programs.

In our experience, a database system such as this can be a powerful tool in managing a group line of business, and it is particularly useful in accomplishing the very difficult task of projecting premium revenues. The end result is a premium projection that should be very accurate and, perhaps most importantly, is available at any time virtually at the touch of a button. Therefore, you cannot use the difficulty of doing premium projections as an excuse not to do financial projections anymore.

ADMINISTRATIVE EXPENSES

A group department's expense budget should be the primary source of the expense assumptions for your financial projection. The expenses that will be covered under this budget will likely include the claim payment function, billing, managed care functions, marketing expenses, and an allocation of home office overhead expenses. You would like to allocate these expenses in some manner to the various projection cells (small groups, pooled groups, etc.) so as to reflect the fact that we do not believe that expenses are a constant percentage of premium over all rating cells. Premium taxes should be projected based upon historical experience and your knowledge of any expected change in the geographical mix for new business.

Finally, commissions should be projected by reviewing past experience to determine what the effective commission rate has been and by looking at anticipated new sales in considering the costs of any bonus programs that the company may have.

INVESTMENT INCOME

In projecting investment income we usually define investable assets as equal to the reserves (claim reserves and unearned premium reserves) on the block of business being projected. We apply a short-term money rate to the investable assets to recognize the short-term nature of investments. However, whatever investment earnings rate is used, it needs to be coordinated with assumed earnings rate assumptions for other lines of business in the company.

REINSURANCE COSTS

This cost item in the projection should represent the estimated net cost of reinsurance (that is, reinsurance premiums less future recoveries). The net cost will represent the reinsurer's expense and profit charge. This amount can best be determined by looking at actual experience regarding reinsurance premiums paid and amounts of recoveries. If

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

TABLE 9

Premium Projection by Anniversary Month

Anniversary Month	Anniversary Month's Premium	Projected Premium (Next Year)
Oct 1, 1988		
Month Total:	$161,264.70	$183,840.41
Nov 1, 1988		
Month Total:	$174,835.47	$199,311.55
Dec 1, 1988		
Month Total:	$91,669.28	$104,503.71
Jan 1, 1989		
Month Total:	$834,782.80	$951,296.89
Feb 1, 1989		
Month Total:	$53,409.50	$60,886.26
Mar 1, 1989		
Month Total:	$151,745.56	$172,988.62
Apr 1, 1989		
Month Total:	$212,617.05	$242,383.20
May 1, 1989		
Month Total:	$146,481.78	$166,988.54
Jun 1, 1989		
Month Total:	$88,524.29	$100,917.58
Jul 1, 1989		
Month Total:	$181,672.65	$207,104.96
Aug 1, 1989		
Month Total:	$104,531.22	$119,164.54
Sep 1, 1989		
Month Total:	$241,237.03	$275,010.10
Total:	$2,442,771.33	$2,784,396.36

Report: PROJ SUMM

SEMINAR FORMAT

TABLE 10

Premium Projection
Starting Month: Sep-89

Projection Date: 18-Sep-89
Projection Time: 09:22 AM

	INPUT	OUTPUT
Anniv. month	Premium for 1 month [database]	Total Premium Projection for month
Oct-88	161,264.70	
Nov-88	174,835.47	
Dec-88	91,669.28	
Jan-89	834,782.80	
Feb-89	53,409.50	
Mar-89	151,745.56	
Apr-89	212,617.05	
May-89	146,481.78	
Jun-89	88,524.29	
Jul-89	181,672.65	
Aug-89	104,531.22	
Sep-89	241,237.03	2,442,771.33
Oct-89	183,840.41	2,465,347.04
Nov-89	199,311.55	2,489,823.12
Dec-90	104,503.71	2,502,657.55
Jan-90	951,296.89	2,619,171.64
Feb-90	60,886.26	2,626,648.40
Mar-90	172,988.62	2,647,891.46
Apr-90	242,383.20	2,677,657.61
May-90	166,988.54	2,698,164.37
Jun-90	100,917.58	2,710,557.66
Jul-90	207,104.96	2,735,989.97
Aug-90	119,164.54	2,750,623.29
Sep-90	275,010.10	2,784,396.36

actual experience is unavailable or inconclusive, then a reasonable approach is to make an assumption about the reinsurer's loss ratio and use the balance of the premium rate as your company's net reinsurance cost.

Now that we have discussed the necessary components of the financial projection, let's review an actual case study to see what we can learn.

CASE STUDY

In this case study we are going to look at a recent projection that we did on a group health block of business and see how it affected management's rating decisions and pricing strategy. This projection was done for an HMO, not a group health insurance company. However, the same principles apply for an insurance company as for an HMO. The projection was produced using APL programming language on a Compaq 386 personal computer.

We actually produced several projections on the various lines of business, including the pooled groups, the jumbo or experience-rated groups, the dental product, various riders to the medical plan, the individual health insurance product, and the group conversion product. We analyzed claim experience separately for each of these lines of business and established claim cost assumptions on a per member per month basis. We could have used per employee per month and probably would have if this had been a projection for a group health insurance company. The total number of members (which includes spouses and children) is generally not known for group health insurance companies. However, the important point is that we use a claim cost assumption that was tied into the exposure units (i.e., members) rather than a claim cost assumption such as a loss ratio that is tied to premium volume. Remember, claims are independent of premiums.

We set up claim cost trend assumptions recognizing expected discontinuities in the future. Such discontinuities for this particular HMO are due to a once a year change in the capitation the HMO pays to a large group practice to provide all professional services to its members. We also knew that the hospital in the community where most of the members receive their inpatient care changes its charge levels once a year, and we reflected this in the trend assumption. Finally, there was an anticipated movement of members to a low option benefit plan during the coming year that we reflected through downward adjustments in the trend.

We relied upon the HMO for its administrative expense budget which we reviewed in the aggregate for reasonableness as compared to prior years. We also relied upon the HMO for an estimated net investment earnings rate, and since this was a projection for the entire organization, not just a block of business, we included interest earnings in the financial projection on all invested assets. Finally, we relied upon the HMO for its negotiated reinsurance premium cost.

As can be seen in Table 11, we projected earnings for 1990 of $9.4 million on $80 million of premium revenue. Under the current premium rate tables and trend assumptions that were in place, we were projecting 1991 earnings to increase to $13.5 million on $90 million of revenue. Target earnings for the HMO (which is owned by a

not-for-profit entity) were only $3 million. Therefore, the HMO management decided that it wanted to reduce 1990 earnings by reducing premium rates and it hoped at the same time to increase its market share. We were asked how much the HMO would have to reduce its premium trend rate in order to bring the projected $9.4 million of earnings down toward the $3 million target.

TABLE 11

Case Study

Projection Results (in $ millions)

	1990	1991
Earned Premium	$ 79.7	$ 89.4
Profit	9.4	13.4
Target Profit	$ 3 million	

I should point out that this work was done in December 1989. When we reviewed the distribution of premium volume by renewal month, we found, as expected, that January was by far the heaviest month for group renewals. Furthermore, by the time we were doing this projection, premium rates had already been quoted for January and February renewal dates. By pushing through the numbers we discovered that, of the $80 million of projected earned premium in 1990, only about $10 million could possibly be affected by a rate change made in late December 1989. So clearly it was unreasonable to attempt to meet the $3 million target profit. The HMO settled on a 7% rate decrease and a 6-month freeze on rate increases. It also made some contractual changes with its providers that increased the projected claims expense somewhat. The result of all these changes was a decrease in the 1990 projected earnings from $9.4 million to $6.2 million (Table 12). But this is when it gets interesting.

TABLE 12

Case Study
Management's Reactions

- 7% rate decrease
- 6 month freeze on renewal rates
- Increased payments to providers

Before-Tax Profit (in $ millions)

	1990	1991
Original Projection	$ 9.4	$ 13.4
Revised Projection	6.2	1.0

Let's look at what happens now to 1991 projected earnings. Remember the original projection was showing a $13.5 million profit in 1991. The immediate 7% rate decrease

combined with a 6-month freeze on premium rates (after which time the premium rates renew their upward track at the premium trend inflation rate) combined with the increased claims expenses reduces the 1991 projected earnings to only $1.0 million. These rating actions taken in December 1989 served to reduce projected 1990 earnings by $3.2 million, but they reduced projected 1991 earnings by over $12 million.

When we look at the projection on a month-by-month basis, we see that by the end of 1991 the HMO is operating approximately on a break-even basis, which if our premium trend is approximately equal to the underlying claim cost trend, then 1992 will merely be a break-even year for the HMO. It will actually be losing money on its insurance operations in 1992 since considerable income is coming from investment earnings.

All of this information was made available to management before it made its rate strategy decisions. Management realized that maybe it was overreacting. However, overreaction is typical whether we are responding to good times by cutting rates or responding to bad times by increasing rates. Everybody seems to do his part to contribute to the underwriting cycle. The good news is that the management made these pricing strategy decisions with its eyes open and with the knowledge of the possible consequences. Part of the strategy is to continue to monitor the claim cost levels and the claim cost trends and then update the projection at mid-year 1990. At that time management will make a decision about whether to extend its rate freeze for another three months or not. Then at the end of the calendar year the projection will be updated again, extending out for another 24 months. Through this continual process of projecting, monitoring experience, updating assumptions, and reprojecting, the management will have forewarning of any adverse trends and have an opportunity to take corrective rating action at the appropriate time.

CLOSING

We have covered a lot of ground regarding group health financial projections. I have given you my arguments as to why I believe that financial projections are the most useful tool available to the group actuary in managing a block of group health business. We have talked about the special characteristics of group health that make it extremely difficult to manage: the lag time in determining what your past costs have been, the difficulty in estimating future costs, and the long-term impact of current rating decisions due to rate guarantee periods and advance quotations.

We have also talked about the mechanics of doing a financial projection: breaking the business down into rating cells, recasting reserves and analyzing past claims experience and trend analysis, and making imaginative use of PC technology and database software to turn what has historically been the most difficult and inaccurate part of the financial projection (the projection of premium revenues) into potentially the easiest and most accurate part.

Finally, we have seen in our case study how a financial projection can be put to use by management and the implications for future earnings of pricing decisions which, without a financial projection, would undoubtedly lead to disappointing surprises in future years.

So what should you do now? Here are my suggestions:

- Set up systems to capture appropriate claim and exposure data, if you are not already doing so.

- Design reports for monitoring financial experience, claim reserve estimates, trends, etc.

- Develop a PC database of all your in-force groups to help you with projections of premium revenue and other types of analyses.

- Do a financial projection -- even if it's only a crude one -- with many approximations. That's the first step. You can refine it and improve upon it later. But if you can at least get something down on paper that you can compare actual results against, you will have gone a long way toward improving your ability to "manage the bottom line" of your group business.

MR. FUHRER: I have been doing claim reserve calculations for many years. The methods I have been using are the standard monthly completion factor methods, otherwise known as development methods. Of course, in the most recent months there are not enough data to use this method. Instead I would estimate incurred claims using loss ratios. Then, I would use something in between these two methods for the months that had some useful data. This involved guessing at the right answer.

I thought that there had to be a better way. I searched around for awhile, and I finally found that there really is a lot of literature written on claim reserve calculation. Most of it is not in the *Transactions*. It's in other actuarial journals, most of which are addressed to nonlife situations. Health insurance is, of course, not life insurance. That may not be so obvious to everybody, because I think most of us who are in the Society of Actuaries know that it is essentially a life society. I put together a bibliography on the subject, which I included in my discussion of, "A Modified Development Method for Deriving Health Claim Reserves," by M. Litow in *TSA* XLI (1989): 127-146. I thought I would try to acquaint you with some of the methods that I found.

I took a limited survey of other health actuaries, and I think most of you will find that this material is new. It's somewhat numerical, if not somewhat technical, and there are some people who might say, "Why do we need to estimate claim reserves any better? We know that judgment always comes into it, so what good are better techniques?" My answer to that is that you want to use the very best techniques you can possibly use at the starting point, and then you use your own judgment to alter those or modify those. If you don't have the best techniques available to start with, then you're so much further behind where you could have been.

Table 13 shows the reserve triangle or the incurred claims by duration. In fact, all of the data and all of the results are shown entirely in Tables 13 through 17. You can refer to these tables if you want to see the data as part of the larger one.

TABLE 13

RESERVE DATA

	1/89	2/89	3/89	4/89	5/89	6/89	7/89	8/89	9/89	10/89	11/89	12/89	Total
PREMIUMS	$6,895,000	$6,929,000	$6,964,000	$6,979,000	$7,010,000	$7,055,000	$7,086,000	$7,116,000	$7,129,000	$7,172,000	$7,219,000	$7,227,000	$84,781,000
PAID CLAIMS													
Duration													
1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701	2,653,243	2,770,744	2,628,455	2,999,514	2,821,610	3,650,871		29,564,784
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959	1,637,751	1,397,650	1,836,762	1,522,017	1,941,455			16,243,450
4	938,060	684,179	807,053	858,014	761,870	659,727	748,480	767,877	626,957				6,852,217
5	423,619	492,487	382,463	390,690	406,811	287,912	368,947	394,610					3,147,539
6	282,134	251,021	208,018	264,399	323,121	203,703	307,747						1,840,142
7	84,864	123,939	90,995	119,534	120,041	100,901							640,275
8	71,519	92,578	140,994	61,638	91,868								458,596
9	58,483	77,672	45,712	47,442									229,110
10	52,272	46,753	46,152										145,177
11	18,856	45,853											64,709
12	22,281												22,281
Total	$6,205,613	$6,282,306	$6,323,908	$6,128,182	$6,152,881	6,008,351	$6,046,159	$6,228,601	$5,653,525	$5,662,400	$4,009,002	$774,438	$65,475,367
CUMULATIVE PAID CLAIMS													
1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,59,240	2,827,457	3,118,612	2,865,373	2,891,210	3,118,356	3,223,335	3,229,353	3,504,550	3,720,945	4,009,002	774,438	35,831,871
3	4,253,526	4,468,025	4,602,521	4,386,465	4,449,170	4,756,107	4,620,985	5,066,115	5,026,567	5,662,400	4,009,002	774,438	52,075,321
4	5,191,586	5,152,204	5,409,574	5,244,479	5,211,040	5,415,834	5,369,465	5,833,992	5,653,525	5,662,400	4,009,002	774,438	58,927,539
5	5,615,205	5,644,691	5,792,037	5,635,169	5,617,851	5,703,746	5,738,412	6,228,601	5,653,525	5,662,400	4,009,002	774,438	62,075,077
6	5,897,338	5,895,712	6,000,055	5,899,568	5,940,972	5,907,450	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	63,915,219
7	5,982,202	6,019,651	6,091,050	6,019,102	6,061,013	6,008,351	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	64,555,494
8	6,053,721	6,112,229	6,232,044	6,080,740	6,152,881	6,008,351	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	65,014,090
9	6,112,204	6,189,701	6,277,756	6,128,182	6,152,881	6,008,351	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	65,243,200
10	6,164,476	6,236,454	6,323,908	6,128,182	6,152,881	6,008,351	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	65,388,377
11	6,183,332	6,282,306	6,323,908	6,128,182	6,152,881	6,008,351	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	65,453,086
12	6,205,613	6,282,306	6,323,908	6,128,182	6,152,881	6,008,351	6,046,159	6,228,601	5,653,525	5,662,400	4,009,002	774,438	65,475,367

TABLE 14

Reserve Data

	1/89	2/89	3/89	4/89	5/89	6/89	7/89	8/89	9/89	10/89	11/89	12/89	Total
LOSS RATIOS													
Duration													
1	0.06166	0.05457	0.06424	0.06625	0.07111	0.06593	0.06387	0.08444	0.07084	0.12540	0.04961	0.10716	0.88509
2	0.30806	0.35349	0.38358	0.34432	0.34133	0.37608	0.39102	0.36937	0.42075	0.39342	0.50573		4.18714
3	0.24718	0.23677	0.21308	0.21795	0.22225	0.23214	0.19724	0.25812	0.21350	0.27070			2.30892
4	0.13605	0.09874	0.11589	0.12294	0.10868	0.09351	0.10563	0.10791	0.08794				0.97730
5	0.06144	0.07108	0.05692	0.05598	0.05803	0.04081	0.05207	0.05545					0.44978
6	0.04092	0.03623	0.02987	0.03788	0.04609	0.02887	0.04343						0.26330
7	0.01231	0.01789	0.01307	0.01713	0.01712	0.01430							0.09182
8	0.01037	0.01336	0.02025	0.00883	0.01311								0.06592
9	0.00848	0.01118	0.00656	0.00680									0.03302
10	0.00758	0.00675	0.00663										0.02096
11	0.00273	0.00662											0.00935
12	0.00323												0.00323
Total	0.90002	0.90667	0.90809	0.87809	0.87773	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.29583
CUMULATIVE LOSS RATIOS													
1	0.06166	0.05457	0.06424	0.06625	0.07111	0.06593	0.06387	0.08444	0.07084	0.12540	0.04961	0.10716	0.88509
2	0.36972	0.40806	0.44782	0.41057	0.41244	0.44201	0.45489	0.45382	0.49159	0.51882	0.55534	0.10716	5.07223
3	0.61690	0.64483	0.66090	0.62852	0.63469	0.67415	0.65213	0.71193	0.70509	0.78951	0.55534	0.10716	7.38115
4	0.75295	0.74357	0.77679	0.75147	0.74337	0.76766	0.75776	0.81984	0.79303	0.78951	0.55534	0.10716	8.35845
5	0.81439	0.81465	0.83171	0.80745	0.80141	0.80847	0.80982	0.87530	0.79303	0.78951	0.55534	0.10716	8.80823
6	0.85531	0.85087	0.86158	0.84533	0.84750	0.83734	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.07153
7	0.86761	0.86876	0.87465	0.86246	0.86462	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.16335
8	0.87799	0.88212	0.89489	0.87129	0.87773	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.22926
9	0.88647	0.89330	0.90146	0.87809	0.87773	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.26229
10	0.89405	0.90005	0.90809	0.87809	0.87773	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.28324
11	0.89678	0.90667	0.90809	0.87809	0.87773	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.29260
12	0.90002	0.90667	0.90809	0.87809	0.87773	0.85164	0.85325	0.87530	0.79303	0.78951	0.55534	0.10716	9.29583

TABLE 15

	1/89	2/89	3/89	4/89	5/89	RESERVE DATA 6/89	7/89	8/89	9/89	10/89	11/89	12/89	Total
PAID CLAIMS AND RESERVES -- MEAN RESERVE FACTOR METHOD													
Duration													
1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701	2,653,243	2,770,744	2,628,455	2,999,514	2,821,610	3,650,871	4,429,273	33,994,057
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959	1,637,751	1,397,650	1,836,762	1,522,017	1,961,455	2,115,929	2,746,490	21,105,869
4	938,060	684,179	807,053	858,014	761,870	659,727	748,480	767,877	626,957	939,231	1,015,952	1,318,712	10,126,113
5	423,619	492,487	382,463	390,690	406,811	287,912	368,947	394,610	416,920	486,839	526,606	683,538	5,261,641
6	282,134	251,021	208,018	264,399	323,121	203,703	307,747	288,659	281,329	328,509	355,343	461,237	3,555,219
7	84,864	123,939	90,995	119,534	120,041	100,901	108,957	117,447	114,465	133,661	144,579	187,666	1,447,047
8	71,519	92,578	140,994	61,638	91,868	91,183	93,410	100,688	98,131	114,588	123,948	160,886	1,241,430
9	58,483	77,472	45,712	47,442	57,661	57,161	58,537	63,098	61,496	71,809	77,675	100,822	777,330
10	52,272	46,753	46,152	47,916	48,560	48,139	49,315	53,158	51,808	60,496	65,438	84,939	654,945
11	18,856	45,853	32,920	32,150	32,582	32,300	33,089	35,667	34,761	40,591	43,907	56,991	439,668
12	22,281	22,638	22,906	22,371	22,671	22,475	23,024	24,818	24,187	28,244	30,551	39,655	305,820
Total	$6,205,613	$6,304,944	$6,379,734	$6,230,619	$6,314,337	6,259,589	$6,412,491	$6,912,136	$6,736,623	$7,866,368	$8,508,928	$11,044,646	$85,176,027
LRs:	0.900	0.910	0.916	0.893	0.901	0.887	0.905	0.971	0.945	1.097	1.179	1.528	1.005
PAID CLAIMS AND RESERVES -- CLASSICAL CHAIN LADDER METHOD													
1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701	2,653,243	2,770,744	2,628,455	2,999,514	2,821,610	3,650,871	4,168,495	33,733,279
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959	1,637,751	1,397,650	1,836,762	1,522,017	1,961,455	2,097,369	2,585,969	20,926,788
4	938,060	684,179	807,053	858,014	761,870	659,727	748,480	767,877	626,957	932,032	1,005,109	1,239,258	10,028,616
5	423,619	492,487	382,463	390,690	406,811	287,912	368,947	394,610	415,490	484,640	522,639	644,392	5,214,699
6	282,134	251,021	208,018	264,399	323,121	203,703	307,747	288,361	280,973	327,734	355,431	435,766	3,526,406
7	84,864	123,939	90,995	119,534	120,041	100,901	108,922	117,403	114,395	133,434	143,896	177,418	1,435,744
8	71,519	92,578	140,994	61,638	91,868	91,320	93,550	100,835	98,251	114,603	123,589	152,380	1,233,126
9	58,483	77,472	45,712	47,442	57,588	57,090	58,484	63,038	61,423	71,646	77,263	95,262	770,905
10	52,272	46,753	46,152	47,884	48,527	48,107	49,282	53,120	51,759	60,373	65,106	80,274	649,609
11	18,856	45,853	32,999	32,227	32,660	32,378	33,168	35,751	34,835	40,633	43,818	54,026	437,204
12	22,281	22,638	22,906	22,371	22,671	22,475	23,024	24,817	24,181	28,205	30,417	37,503	303,489
Total	$6,205,613	$6,304,944	$6,379,813	$6,230,664	$6,314,328	$6,259,721	$6,412,590	$6,911,927	$6,734,832	$7,855,700	$8,471,640	$10,445,180	$84,526,953
LRs:	0.900	0.910	0.916	0.893	0.901	0.887	0.905	0.971	0.945	1.095	1.174	1.445	0.997
PAID CLAIMS AND RESERVES -- MODIFIED CHAIN LADDER METHOD													
1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701	2,653,243	2,770,744	2,628,455	2,999,514	2,821,610	3,650,871	3,996,742	33,561,525
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959	1,637,751	1,397,650	1,836,762	1,522,017	1,961,455	2,174,960	2,424,324	20,842,734
4	938,060	684,179	807,053	858,014	761,870	659,727	748,480	767,877	626,957	847,104	1,022,884	1,140,160	9,862,366
5	423,619	492,487	382,463	390,690	406,811	287,912	368,947	394,610	617,163	438,593	529,604	590,324	5,123,222
6	282,134	251,021	208,018	264,399	323,121	203,703	307,747	270,926	279,093	293,430	354,319	394,942	3,432,851
7	84,864	123,939	90,995	119,534	120,041	100,901	106,025	110,221	113,544	119,376	144,147	160,674	1,394,262
8	71,519	92,578	140,994	61,638	91,868	90,949	91,341	94,956	97,819	102,844	124,185	138,423	1,199,113
9	58,483	77,472	45,712	47,442	53,491	56,958	57,203	59,467	61,260	64,407	77,772	86,688	746,355
10	52,272	46,753	46,152	45,244	45,257	48,190	48,398	50,313	51,830	54,492	65,800	73,344	628,044
11	18,856	45,853	32,088	30,288	30,296	32,260	32,399	33,681	34,696	36,479	44,048	49,099	420,043
12	22,281	21,314	22,174	20,930	20,936	22,293	22,389	23,275	23,977	25,209	30,440	33,930	289,149
Total	$6,205,613	$6,303,620	$6,378,171	$6,224,644	$6,302,861	$6,259,001	$6,403,914	$6,871,440	$6,782,907	$7,644,334	$8,577,159	$9,863,087	$83,766,751
LRs:	0.900	0.910	0.916	0.892	0.899	0.887	0.904	0.966	0.944	1.066	1.188	1.365	0.988

TABLE 16

LOSS RATIOS AND LOSS RATIO RESERVES -- MEAN LOSS RATIO METHOD

Duration	1/89	2/89	3/89	4/89	5/89	6/89	7/89	8/89	9/89	10/89	11/89	12/89	Total
1	0.06166	0.05457	0.06424	0.06625	0.07111	0.06593	0.06387	0.08444	0.07084	0.12540	0.04961	0.10716	
2	0.30806	0.35349	0.38358	0.34432	0.34133	0.37608	0.39102	0.36937	0.42075	0.39342	0.50573	0.38065	
3	0.24718	0.23677	0.21308	0.21795	0.22225	0.23214	0.19724	0.25812	0.21350	0.27070	0.23089	0.23089	
4	0.13605	0.09874	0.11589	0.12294	0.10868	0.09351	0.10563	0.10791	0.08794	0.10859	0.10859	0.10859	
5	0.06144	0.07108	0.05492	0.05598	0.05803	0.04081	0.05207	0.05545	0.05622	0.05622	0.05622	0.05622	
6	0.04092	0.03623	0.02987	0.03788	0.04609	0.02887	0.04343	0.03761	0.03761	0.03761	0.03761	0.03761	
7	0.01231	0.01789	0.01307	0.01713	0.01712	0.01430	0.01530	0.01530	0.01530	0.01530	0.01530	0.01530	
8	0.01037	0.01336	0.02025	0.00883	0.01311	0.01318	0.01318	0.01318	0.01318	0.01318	0.01318	0.01318	
9	0.00848	0.01118	0.00656	0.00680	0.00826	0.00826	0.00826	0.00826	0.00826	0.00826	0.00826	0.00826	
10	0.00758	0.00675	0.00663	0.00699	0.00699	0.00699	0.00699	0.00699	0.00699	0.00699	0.00699	0.00699	
11	0.00273	0.00662	0.00468	0.00468	0.00468	0.00468	0.00468	0.00468	0.00468	0.00468	0.00468	0.00468	
12	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	0.00323	
Total	0.90002	0.90990	0.91599	0.89298	0.90088	0.88798	0.90489	0.96454	0.93850	1.04358	1.04029	0.97276	

PAID CLAIMS AND RESERVES -- MEAN LOSS RATIO METHOD

1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701	2,653,243	2,770,744	2,628,455	2,999,514	2,821,610	3,650,871	2,750,952	32,315,736
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959	1,637,751	1,397,650	1,836,762	1,522,017	1,941,455	1,666,812	1,668,659	19,578,921
4	938,060	684,179	807,053	858,014	761,870	659,727	748,480	767,877	626,957	778,798	783,902	784,771	9,199,689
5	423,619	492,487	382,463	390,690	406,811	287,912	368,947	394,610	400,809	403,227	405,869	406,319	4,763,764
6	282,134	251,021	208,018	264,399	323,121	203,703	307,747	267,663	268,152	269,769	271,537	271,838	3,189,101
7	86,864	123,939	90,995	119,534	120,041	100,901	108,434	108,893	109,092	109,750	110,470	110,592	1,297,507
8	71,519	92,578	140,994	61,638	91,868	93,009	93,417	93,813	93,984	94,551	95,171	95,276	1,117,817
9	58,483	77,472	45,712	47,442	57,876	58,247	58,503	58,751	58,858	59,213	59,601	59,667	699,827
10	52,272	46,753	46,152	48,750	48,967	49,281	49,498	49,707	49,798	50,098	50,427	50,482	592,185
11	18,856	45,853	32,565	32,635	32,780	32,990	33,135	33,275	33,336	33,537	33,757	33,795	396,515
12	22,281	22,391	22,504	22,552	22,653	22,798	22,898	22,995	23,037	23,176	23,328	23,354	273,966
Total	$4,205,613	$6,304,697	$6,378,977	$6,232,119	$6,315,156	$6,264,676	$6,412,045	$6,863,699	$6,690,592	$7,484,521	$7,509,876	$7,030,144	$79,692,115
LRs:	0.900	0.910	0.916	0.893	0.901	0.888	0.905	0.965	0.939	1.044	1.040	0.973	0.940

TABLE 17

	1/89	2/89	3/89	4/89	5/89	6/89	7/89	8/89	9/89	10/89	11/89	12/89	Total
bi	0.9028	0.9519	0.9854	0.9281	0.9242	0.9779	0.9778	1.0122	1.0408	1.0877	1.3049	1.4529	
ti	12	11	10	9	8	7	6	5	4	3	2	1	
m =	66												
a^2 = 0.00025518		a = 0.000558021											
wi =	4.4248	4.4252	4.4262	4.4275	4.4309	4.4355	4.4635	4.5274	4.7827	6.4195	91.9092	183.8185	
bi	0.9028	0.9519	0.9854	0.9281	0.9242	0.9779	0.9778	1.0122	1.0408	1.0877	1.3049	1.4529	
zi =	0.8317	0.8317	0.8317	0.8316	0.8315	0.8314	0.8305	0.8285	0.8205	0.7731	0.1922	0.1063	
Bi =	0.9191	0.9600	0.9878	0.9402	0.9370	0.9816	0.9815	1.0101	1.0335	1.0678	1.0586	1.0481	

PAID CLAIMS AND RESERVES -- CREDIBILITY METHOD

Duration													
1	$425,166	$378,134	$447,362	$462,374	$498,510	$465,113	$452,591	$600,899	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701	2,653,243	2,770,744	2,628,455	2,999,514	2,821,610	3,650,871	2,883,399	32,448,183
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959	1,637,151	1,397,650	1,836,762	1,522,017	1,941,455	1,764,477	1,748,998	19,756,925
4	938,060	684,179	807,053	858,014	761,870	659,727	748,480	767,877	626,957	831,603	829,834	822,554	9,336,208
5	423,619	492,487	382,663	390,690	406,811	287,912	368,947	394,610	414,228	430,567	429,651	425,882	4,847,866
6	282,134	251,021	208,018	266,399	323,121	203,703	307,747	270,366	277,130	288,060	287,448	284,926	3,248,071
7	84,866	123,939	90,995	119,534	120,041	100,901	106,433	109,993	112,745	117,192	116,942	115,916	1,319,496
8	71,519	92,578	140,994	61,638	91,868	91,297	91,693	94,760	97,131	100,962	100,747	99,863	1,135,049
9	58,483	77,472	45,712	47,442	54,229	57,175	57,424	59,344	60,829	63,228	63,094	62,540	706,973
10	52,272	46,753	46,152	45,835	45,882	48,374	48,584	50,209	51,465	53,495	53,381	52,913	595,315
11	18,856	45,853	32,168	30,683	30,715	32,383	32,524	33,612	34,452	35,811	35,735	35,422	398,213
12	22,281	21,495	22,230	21,204	21,225	22,378	22,476	23,227	23,808	24,747	24,695	24,478	274,245
Total	$6,205,613	$6,303,801	$6,378,306	$6,225,903	$6,304,932	$ 6,259,958	$ 6,405,292	$6,870,113	$6,725,313	$7,608,066	$ 7,715,005	$7,331,329	$80,333,631
LRs:	0.900	0.910	0.916	0.892	0.899	0.887	0.904	0.965	0.943	1.061	1.069	1.014	0.948

LOSS RATIO SUMMARY

Method												
Res Ave	0.900	0.910	0.916	0.893	0.901	0.887	0.905	0.971	0.945	1.097	1.179	1.528	1.005
CCL	0.900	0.910	0.916	0.893	0.901	0.887	0.905	0.971	0.945	1.095	1.174	1.445	0.997
ModCL	0.900	0.910	0.916	0.892	0.899	0.887	0.904	0.966	0.944	1.066	1.188	1.365	0.988
MeanLR	0.900	0.910	0.916	0.893	0.901	0.888	0.905	0.965	0.939	1.044	1.040	0.973	0.940
Cred	0.900	0.910	0.916	0.892	0.899	0.887	0.904	0.965	0.943	1.061	1.069	1.014	0.948

We're going to introduce some notation to you so we can write out some formulas on these data. We're going to let $X_{i,d}$ be claim payments for incurred month i in duration month d. For example, incurred claims in incurred month i for duration 1 is $425,166, which you can see on Exhibit 1. Month 2 duration 3 would be $1,640,568, and month 4 duration 5 is $390,690.

I've also included premiums for each of these 12 incurred months, only the first five are on Exhibit 1. It doesn't have to be premiums used here. You might want to use exposures, and you might even want to use some sort of untended premiums that to keep everything on a consistent basis. If you think premiums bear a nice relationship to claims evenly through the period, then that's a good thing to use. If you don't, because of odd renewal dates, etc. then you could use some sort of exposure. Whatever you prefer can be used.

I'm going to assume that, in my triangle of claims paid, that we only have D months worth of claim data (Exhibit 2). In the illustrations D is equal to 12. So if you're in incurred month 5, then you only have 8 months worth of paid claims. In other words, May only runs through December. I think probably you've all seen triangles like this.

Here is just a little more notation. I'm going to let Y be the cumulative claims paid through duration d for incurred month i. That is, $Y_{i,d}$ is equal to the summation of durations 1 to d of X_i. There are some examples on Exhibit 3. For month 1, cumulative claims through month 5 are $5,615,205 and that would just be the sum of the first 5 X′ in the 1st column of Exhibit 1. Then to complete the notation, the premium for months i, I call P_i, see Exhibit 4. I've also defined some of these claims as loss ratios where $X'_{i,d}$ is just $X'_{i,d}$ divided by P_i and, also, $Y'_{i,d}$ is the loss ratio cumulative through month d. See Exhibit 5.

So how do we calculate reserves? See Exhibit 6. Well, to my knowledge, the way that's used in most health insurance companies is something that you might call the mean reserve factor method. I made up that name, but what basically is done in practically every reserve method that I know of is that, if you want to estimate, say, paid month i,d, then you take the ratio of month d to the total of the prior durations for each of the incurred months that you have data for duration d. Then you form some sort of average of these ratios. Then you multiply the average ratio by the sum of the payments in incurred month i prior to duration d. The product is your estimate. Now, of course, how you get the average ratio can vary. There can actually be hundreds of ways of doing the average, and there are some interesting questions about which are best. The method of Exhibit 7 that I call the mean ratio method, uses the mean of the ratios.

All the methods continue by using the estimate of duration d in duration d+1. When I looked at the literature, I found that a lot of people were doing this in other kinds of insurance and, in fact, they call the method the chain ladder method, which was something new to me (Exhibit 8). I guess it comes from the fact that you take ratios to get certain quantities, and then you take further ratios on top of those like a ladder.

I came across this quote, "The methods which take means and then ratios of these means tend to be superior to methods which take ratios and then means of the ratios." And so,

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 1

RESERVES

NOTATION:

Let: $X_{i,d}$ = claim payments in duration d inccured in month i.

Examples:

$X_{1,1}$ = \$425,166, $X_{2,3}$ = \$1,640,568, and $X_{4,5}$ = \$390,690

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Premiums					
	\$6,895,000	\$6,929,000	\$6,964,000	\$6,979,000	\$7,010,000
Paid Claims					
Duration					
1	\$425,166	\$378,134	\$447,362	\$462,374	\$498,510
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959
4	938,060	684,179	807,053	858,014	761,870
5	423,619	492,487	382,463	390,690	406,811
6	282,134	251,021	208,018	264,399	323,121
7	84,864	123,939	90,995	119,534	120,041
8	71,519	92,578	140,994	61,638	91,868
9	58,483	77,472	45,712	47,442	
10	52,272	46,753	46,152		
11	18,856	45,853			
12	22,281				
TOTAL	\$6,205,613	\$6,282,306	\$6,323,908	\$6,128,182	\$6,152,881

Assume that we have data for incurred months 1 through D and therefore for each i, $X_{i,d}$ is available only for $d \leq (D+1-i)$.

SEMINAR FORMAT

EXHIBIT 2

Cumulative Paid Claims					
1	$425,166	$378,134	$447,362	$462,374	$498,510
2	2,549,240	2,827,457	3,118,612	2,865,373	2,891,210
3	4,253,526	4,468,025	4,602,521	4,386,465	4,449,170
4	5,191,586	5,152,204	5,409,574	5,244,479	5,211,040
5	5,615,205	5,644,691	5,792,037	5,635,169	5,617,851
6	5,897,338	5,895,712	6,000,055	5,899,568	5,940,972
7	5,982,202	6,019,651	6,091,050	6,019,102	6,061,013
8	6,053,721	6,112,229	6,232,044	6,080,740	6,152,881
9	6,112,204	6,189,701	6,277,756	6,128,182	
10	6,164,476	6,236,454	6,323,908		
11	6,183,332	6,282,306			
12	6,205,613				

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 3

$Y_{i,d}$ = cumulative claims paid through duration d for incurred month i.

$$Y_{i,d} = \sum_{r=1}^{d} X_{i,r}$$

Examples:
$Y_{1,5}$ = \$5,615,205 $Y_{2,3}$ = \$4,468,025, and $Y_{3,4}$ = \$5,409,574.

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Cumulative Paid Claims					
1	\$425,166	\$378,134	\$447,362	\$462,374	\$498,510
2	2,549,240	2,827,457	3,118,612	2,865,373	2,891,210
3	4,253,526	4,468,025	4,602,521	4,386,465	4,449,170
4	5,191,586	5,152,204	5,409,574	5,244,479	5,211,040
5	5,615,205	5,644,691	5,792,037	5,635,169	5,617,851
6	5,897,338	5,895,712	6,000,055	5,899,568	5,940,972
7	5,982,202	6,019,651	6,091,050	6,019,102	6,061,013
8	6,053,721	6,112,229	6,232,044	6,080,740	6,152,881
9	6,112,204	6,189,701	6,277,756	6,128,182	6,152,881
10	6,164,476	6,236,454	6,323,908	6,128,182	6,152,881
11	6,183,332	6,282,306	6,323,908	6,128,182	6,152,881
12	6,205,613	6,282,306	6,323,908	6,128,182	6,152,881

EXHIBIT 4

P = Premium for month i.

Examples: P_1 = \$6,895,000 and P_3 = \$6,964,000.

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Premiums					
	\$6,895,000	\$6,929,000	\$6,964,000	\$6,979,000	\$7,010,000

EXHIBIT 5

Also define the loss ratio quantitites $X'_{i,d} = X_{i,d}/P_i$ and $Y'_{i,d} = Y_{i,d}/P_i$.

Examples

$X'_{1,1} = 0.06166$, $Y'_{2,3} = 0.64483$, and $Y'_{3,5} = 0.83171$.

Reserve Data					
Duration	1/89	2/89	3/89	4/89	5/89
			Loss Ratios		
1	0.06166	0.05457	0.06424	0.06625	0.07111
2	0.30806	0.35349	0.38358	0.34432	0.34133
3	0.24718	0.23677	0.21308	0.21795	0.22225
4	0.13605	0.09874	0.11589	0.12294	0.10868
5	0.06144	0.07108	0.05492	0.05598	0.05803
6	0.04092	0.03623	0.02987	0.03788	0.04609
7	0.01231	0.01789	0.01307	0.01713	0.01712
8	0.01037	0.01336	0.02025	0.00883	0.01311
9	0.00848	0.01118	0.00656	0.00680	
10	0.00758	0.00675	0.00663		
11	0.00273	0.00662			
12	0.00323				
Total	0.90002	0.90667	0.90809	0.87809	0.87773

Cumulative Loss Ratios					
1	0.06166	0.05457	0.06424	0.06625	0.07111
2	0.36972	0.40806	0.44782	0.41057	0.41244
3	0.61690	0.64483	0.66090	0.62852	0.63469
4	0.75295	0.74357	0.77679	0.75147	0.74337
5	0.81439	0.81465	0.83171	0.80745	0.80141
6	0.85531	0.85087	0.86158	0.84533	0.84750
7	0.86761	0.86876	0.87465	0.86246	0.86462
8	0.87799	0.88212	0.89489	0.87129	0.87773
9	0.88647	0.89330	0.90146	0.87809	0.87773
10	0.89405	0.90005	0.90809	0.87809	0.87773
11	0.89678	0.90667	0.90809	0.87809	0.87773
12	0.90002	0.90667	0.90809	0.87809	0.87773

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 6

RESERVES

Reserve factor R_d defined as $E(X_{i,d}/Y_{i,d-1})$ is estimated from data for d=2 through D. A number of estimators for this have been used.

MEAN RESERVE FACTORS

$$\hat{R}_d = \frac{1}{(D+1-d)} \sum_{i=1}^{D+1-d} X_{i,d}/Y_{i,d} \quad ' \; 2 \leq d \leq D$$

Example:

$$\hat{R}_{11} = 1/2[18,856/6,164,476) + (45,853/6,236,454)] = 0.00521$$

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Paid Claims					
Duration					
1	$425,166	$378,134	$447,362	$462,374	$498,510
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959
4	938,060	684,179	807,053	858,014	761,870
5	423,619	492,487	382,463	390,690	406,811
6	282,134	251,021	208,018	264,399	323,121
7	84,864	123,939	90,995	119,534	120,041
8	71,519	92,578	140,994	61,638	91,868
9	58,483	77,472	45,712	47,442	
10	52,272	46,753	46,152		
11	18,856	45,853			
12	22,281				

SEMINAR FORMAT

EXHIBIT 7

RESERVES

After the $\hat{R}$ are calculated, set $\hat{X}_{i,d} = \hat{R}_d Y_{i,d-1}$ for d = D+2-i, for each i from 2 through D. Then set $\hat{Y}_{i,d} = Y_{i,d} + \hat{X}_{i,d-1}$ and continue with $\hat{X}_{i,d+1} = \hat{R}_{d+1}\hat{Y}_{i,d}$ until each $\hat{Y}_{i,D}$ is estimated.

Example:

$\hat{X}_{3,11} = \hat{R}_{11}Y_{3,10} = 0.00521\ (6{,}323{,}908) = 32{,}920,$

$\hat{Y}_{3,11} -= \hat{X}_{3,11} + Y_{3,10} = 32{,}920 + 6{,}323{,}908 = 6{,}356{,}828,$

$\hat{X}_{3,12} = \hat{R}_{12}\hat{Y}_{3,11} = (22{,}281/6{,}183{,}332)\ (6{,}356{,}828) = 22{,}906,$

$\hat{Y}_{3,12} = \hat{X}_{3,12} + \hat{Y}_{3,11} = 22{,}906 + 6{,}356{,}828 = 6{,}379{,}734.$

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Paid Claims and Reserves -- Mean Reserve Factor Method					
Duration					
1	$425,166	$378,134	$447,362	$462,374	$498,510
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959
4	938,060	684,179	807,053	858,014	761,870
5	423,619	492,487	382,463	390,690	406,811
6	282,134	251,021	208,018	264,399	323,121
7	84,864	123,939	90,995	119,534	120,041
8	71,519	92,578	140,994	61,638	91,868
9	58,483	77,472	45,712	47,442	57,641
10	52,272	46,753	46,152	47,916	48,560
11	18,856	45,853	32,920	32,150	32,582
12	22,281	22,638	22,906	22,371	22,671
Total	$6,205,613	$6,304,944	$6,379,374	$6,230,619	$6,314,337
LRs:	0.900	0.910	0.916	0.893	0.901

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 8

CHAIN LADDER

Taylor and Mathews [3] (also quoted in Taylor [2]) prove that "methods which take means and then ratios of these means tend to be superior to methods which take ratios and then means of these ratios."

$$\hat{R} = \frac{\sum_{i=1}^{D+1-d} X_{i,d}}{\sum_{i=1}^{D+1-d} Y_{i,d-1}} \quad Example: \hat{R}_{11} = \frac{18,856 + 45,853}{6,164,476 + 6,236,454} = 0.00522$$

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Paid Claims					
1	$425,166	$378,134	$447,362	$462,374	$498,510
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959
4	938,060	684,179	807,053	858,014	761,870
5	423,619	492,487	382,463	390,690	406,811
6	282,134	251,021	208,018	264,399	323,121
7	84,864	123,939	90,995	119,534	120,041
8	71,519	92,578	140,994	61,638	91,868
9	58,483	77,472	45,712	47,442	
10	52,272	46,753	46,152		
11	18,856	45,853			
12	22,281				
Cumulative Paid Claims					
1	$425,166	$378,134	$447,362	$462,374	$498,510
2	2,549,240	2,827,457	3,118,612	2,865,373	2,891,210
3	4,253,526	4,468,025	4,602,521	4,386,465	4,449,170
4	5,191,586	5,152,204	5,409,574	5,244,479	5,211,040
5	5,615,205	5,644,691	5,792,037	5,635,169	5,617,851
6	5,897,338	5,895,712	6,000,055	5,899,568	5,940,972
7	5,982,202	6,019,651	6,091,050	6,019,102	6,061,013
8	6,053,721	6,112,229	6,232,044	6,080,740	6,152,881
9	6,112,204	6,189,701	6,277,756	6,128,182	
10	6,164,476	6,236,454	6,323,908		
11	6,183,332	6,282,306			
12	6,205,613				

consequently, the way that the chain ladder method is used by a lot of nonhealth actuaries is that they don't calculate the ratios and then average them some way. They add up all the claims in the numerator and the denominator and then divide. If there's one thing I can leave you with, it is that you ought to do it this way. Your estimate of the ratio for a particular month, say, 11, is the sum of all the claims paid in month 11 divided by all the claims paid prior to the eleventh month for the periods in which you have at least that much data. This is illustrated in Exhibit 7.

The thing that everybody generally does is that, when it comes to the most recent month, since you only have one month of paid claims in the month that it's incurred, not only because some of the claims are incurred towards the end of the month, but also just that it takes at least a month for things to get processed), you have very few claims paid. It is recognized, I think by everybody, that you can't just use this chain ladder or reserve factor method to calculate estimated claims incurred during the most recent month. Actuaries are not sure about the second, third and fourth month back, and then everybody's happy past there. So essentially they use another method, which I'm going to call the loss ratio method. In this method you calculate an average loss ratio for duration d, which is merely the average of all the loss ratios that came before for that duration. In the case of, for example, the eleventh month, it's merely the two loss ratios and then you take the average of these two and that's .00468 (Exhibit 9). You then assume that the ratio is going to be the same for all of the remaining months that you're trying to fill in at that duration. You multiply each of the averaged loss ratios by the premium for that month, and you've come up with loss ratio estimates for the unknown month.

Now, I know some people have a tendency to estimate loss ratios from the past and just use that estimate for all of the claims in the month, but I'm not sure why you'd want to throw out the fact that claims were high and low in the one, two, or three months that you have. I mean the paid claims for the incurred month should at least affect your answer a little bit. So this would be more or less the method I'd recommend in which you're just projecting the loss ratio. Immediately the problem comes up that we get a whole lot different reserves using this method compared to using the method where we use reserve factors and we're not sure which one to use. It seemed to me for a long time that the right method would be some sort of average between the two. For the most recent month you'd probably want to use the mean loss ratio method about a 100%. When you go back to the second, third, fourth month back you'd probably want to grade down by using for the second month back say 80% of the loss ratio method and 20% of reserve factor method and maybe only 50% for the third month back, etc. I even did some reserves that way in which I made up those percentages, and I was casting around for some way of determining what percentages were optimum. I found the paper that was published in 1982 by an actuary named DeVylder in *Insurance: Mathematics and Economics*, and he actually calculated or gave some formulas to calculate how to come up with these kind of credibility percentages, so that you could actually come up with some sort of weighted average between the two methods. I thought that was just great. I mean it seems like the perfect way of doing things. A bunch of formulas that tell you how to calculate these things.

The first thing that he did was modify the chain ladder method a little bit (he doesn't call it that, but it's really what's going on). See Exhibit 10. It turns out to be a more

EXHIBIT 9

MEAN LOSS RATIO METHOD

Usually it is realized that there is not enough data in the most recent months for the chain ladder method to be accurate. An incurred claim estimate reserve (for all the runout is illustrated) is calculated by:

$$Set\ \overline{X}_d^I = \frac{1}{(D+1-d)} \sum_{i=1}^{D+1-d} X_{i,d}^I$$

for all d from 1 to D. Then the estimate of

$$each\ X_{i,d}^I\ for\ d > (D+1-i),\ is:\ \hat{X}_{i,d}^L = \overline{X}_d^I P_i.$$

$$Example:\ \overline{X}_{11}^I = 1/2(0.00273 + 0.00662) = 0.00468$$

Reserve Data					
Duration	1/89	2/89	3/89	4/89	5/89
Loss Ratios and Loss Ratio Reserves -- Mean Loss Ratio Method					
1	0.06166	0.05457	0.06424	0.06625	0.07111
2	0.30806	0.35349	0.38358	0.34432	0.34133
3	0.24718	0.23677	0.21308	0.21795	0.22225
4	0.13605	0.09874	0.11589	0.12294	0.10868
5	0.06144	0.07108	0.05492	0.05598	0.05803
6	0.04092	0.03623	0.02987	0.03788	0.04609
7	0.01231	0.01789	0.01307	0.01713	0.01712
8	0.01037	0.01336	0.02025	0.00883	0.01311
9	0.00848	0.01118	0.00656	0.00680	0.00826
10	0.00758	0.00675	0.00663	0.00699	0.00699
11	0.00273	0.00662	0.00468	0.00468	0.00468
12	0.00323	0.00323	0.00323	0.00323	0.00323
Total	0.90002	0.90990	0.91599	0.89298	0.90088

SEMINAR FORMAT

EXHIBIT 9

(Continued)

MEAN LOSS RATIO METHOD

$$\hat{X}^L_{3,11} = 0.00468(6,964,000) = 32,565$$
$$=$$
$$=$$
$$=$$
$$\hat{Y}^L_{3,11} = \hat{X}^L_{3,11} + Y_{3,10} = 32,565 + 6,323,908 = 6,356,473,$$
$$=$$
$$=$$
$$=$$
$$\hat{X}^L_{3,12} = \bar{X}'_{12} P_{11} = (22,281/6,895,000)\ (6,964,000) = 22,504,$$
$$=$$
$$=$$
$$=$$
$$\hat{Y}^L_{3,12} = \hat{X}^L_{3,12} + \hat{Y}^L_{3,11} = 6,356,473 + 22,504 = 6,378,977.$$

Reserve Data					
	1/89	2/89	3/89	4/89	5/89
Paid Claims and Reserves -- Mean Loss Ratio Method					
1	$ 425,166	$ 378,134	$ 447,362	$ 462,374	$ 498,510
2	2,124,074	2,449,323	2,671,250	2,402,999	2,392,701
3	1,704,286	1,640,568	1,483,909	1,521,092	1,557,959
4	938,060	684,179	807,053	858,014	761,870
5	423,619	492,487	382,463	390,690	406,811
6	282,134	251,021	208,018	264,399	323,121
7	84,864	123,939	90,995	119,534	120,041
8	71,519	92,578	140,994	61,638	91,868
9	58,483	77,472	45,712	47,442	57,876
10	52,272	46,753	46,152	48,750	48,967
11	18,856	45,853	32,565	32,635	32,780
12	22,281	22,391	22,504	22,552	22,653
Total	$6,205,613	$6,304,697	$6,378,977	$6,232,119	$6,315,156
LRs:	0.900	0.910	0.916	0.893	0.901

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 10

MODIFIED CHAIN LADDER RESERVES

In order to use this method (See Exhibit 12 Bibliography DeVylder [1]) we should use a slightly modified chain ladder. Determine a b_1 for each 1 from 2 through

D:

$$\hat{b}_i = \frac{\sum_{d=1}^{D+1-i} \overline{X}_d^I X_{i,d}^I}{\sum_{d=1}^{D+1-i} [\overline{x}_d^I]^2} \text{ and set } \hat{X}_{i,d}^M = \hat{b}_i \hat{X}_{i,d}^L = \hat{b}_i \overline{X}_d^I P_i \text{ for each } i \text{ and}$$

d, with d> (D+1-i).

$$\text{Example: } \hat{b}_{11} = \frac{0.7376(0.04961) + 0.38065(0.50573)}{(0.7376)^2 + (0.38065)^2} = 1.3049$$

Reserve Data					
8/89	9/89	10/89	11/89	12/89	Total
Loss Ratios					
0.08444	0.07084	0.12540	0.04961	0.10716	0.88509
0.36937	0.42075	0.39342	0.50573		4.18714
0.25812	0.21350	0.27070			2.30892
0.10791	0.08794				0.97730
0.05545					0.44978

SEMINAR FORMAT

EXHIBIT 10

(Continued)

$$\hat{X}^{M}_{11,5} = 1.3049(405,869^{*}) = 529,604$$

* From Table 16

Reserve Data						
	8/89	9/89	10/89	11/89	12/89	Total
Paid Claims and Reserves -- Modified Chain Ladder Method						
1	$ 600,899	$ 505,037	$ 899,335	$ 358,130	$ 774,438	$ 6,267,088
2	2,628,455	2,999,514	2,821,610	3,650,871	3,996,742	33,561,525
3	1,836,762	1,522,017	1,941,455	2,174,960	2,424,324	20,842,734
4	767,877	626,957	847,104	1,022,884	1,140,160	9,862,366
5	394,610	417,163	438,593	529,604	590,324	5,123,222
6	270,926	279,093	293,430	354,319	394,942	3,432,851
7	110,221	113,544	119,376	144,147	160,674	1,394,262
8	94,956	97,819	102,844	124,185	138,423	1,199,113
9	59,467	61,260	64,407	77,772	86,688	746,355
10	50,313	51,830	54,492	65,800	73,344	628,044
11	33,681	34,696	36,479	44,048	49,099	420,043
12	23,275	23,977	25,209	30,440	33,930	289,149
Total	$6,871,440	$6,732,907	$7,644,334	$8,577,159	$9,863,087	$83,766,751
LRs	0.966	0.944	1.066	1.188	1.365	0.988

convenient form to write things in. It wouldn't be necessary to do this if you use this method though. I mean you could just calculate your reserve factor and claim reserves exactly the same way as you normally would, I hope by taking averages and then ratios, not averages of ratios.

Then to use his method you have to work through and calculate a couple of quantities described in Exhibit 11. If you've been following the notation, you won't have any trouble with it. The credibility for incurred month is z_i. There is a constant, a which applies to the whole matrix and a turns out to be a function of some of all these z_i's which are in turn a function of a. So you have to guess at an a and then just use successive approximations. DeVylder does prove it will always converge, so it's not a problem to do that. I've done it on spreadsheet software, and after about nine or ten iterations, it doesn't change anymore.

Let's take a look at the summary of what happened for the sample data I have, Exhibit 12. The data are actually a group of claims that I extracted from my Blue Cross data. The premiums I made up and the block of cases were randomly selected, so they are really meaningless data, but they were very illustrative of what could happen with these things. I've illustrated the total loss ratio, not the reserves, so very small differences can actually be relatively large differences in reserves. When I use the reserve average method, I got a 1.528 loss ratio for the most recent month. This does not look like a reasonable number. The so-called classical chain ladder method had a little lower answer. The credibilty reserves gave a loss ratio of 0.48. This answer's probably one that you might have used by guessing, but I maintain that you're better off going through formulas like these, getting that answer and then deciding if you like it or not rather than just sort of guessing at the answer. I think it's something that we ought to learn.

The only thing that I should mention here is that I'm assuming in all this that there's no seasonality in claims, which is almost true nowadays, but not completely true, and that the length of the months are roughly the same. As you know, the differences in paid days in months can make a difference. I am also assuming that you have some sort of consistent method of assigning incurred dates to claims that does not create extra seasonality. You can also use this kind of method for reserves on groups at renewal, but you would probably need a big enough case so that you would be using of the groups' own reserve factors. This brings up some areas of further research, to modify these methods for the differences in the length of months and seasonality. Also there may be a way to use a sort of triple credibility for a particular case's reserves, where you give some credibility to of the groups' own reserve factors, some credibility to extending the groups' loss ratios and some credibility to the corporate reserve factors.

MR. MARTIN E. STAEHLIN: I just wanted to know if any of these methods are adaptable to develop estimates of say the fourth, fifth, sixth, etc., durations of paid claims and then decide when you are fully incurred by the way they're developing instead of trying to judge where ultimate claims are? Did you understand what I'm saying?

MR. FUHRER: Each of the methods, every single one of them, developed incurred claims by duration. In other words, each of the months, after the ones that already were

SEMINAR FORMAT

EXHIBIT 11

CREDIBILITY AVERAGE OF TWO METHODS

Determine a credibility average of the two methods in seven steps:

1. Let: $t_i = D+1-i$

2. Let: $m = \sum_{i=1}^{D} (t_i-1)$

3. Let: $\hat{s}^2 = \frac{1}{m} \sum_{i=1}^{D} \sum_{d=1}^{t_i} [X'_{i,d} - \hat{b}_i \bar{X}_d']^2$

4. Let: $w_i = 1 \Big/ \left[\sum_{d=1}^{t_i} [\bar{X}_d']^2 \right]$

5. Determine $\hat{a} = \frac{1}{D} \sum_{i=1}^{D} z_i (\hat{b}_i-1)^2$ and z_i for i = 1 through D

and $z_i = a/(a+\hat{s}^2 w_i)$. This has to be done by guessing a>0, getting successive approximations by first calculating the z's then a, and continuing until the z's do not change.

6. set $B_i = z_i \hat{b}_i + (1-z_i)$

7. Determine $\hat{X}^C_{i,d} = B_i \hat{X}^L_{i,d} = B_i \bar{X}_d' P_i$

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 11

(Continued)

Reserve Data				
wi =	4.7827	6.4195	91.9092	183.8185
bi	1.0408	1.0877	1.3049	1.4529
zi =	0.8205	0.7731	0.1922	0.1063
Bi =	1.0335	1.0678	1.0586	1.0481

	9/89	10/89	11/89	12/89	Total
Paid Claims and Reserves - Credibility Method					
1	$505,037	$899,335	$358,130	$774,438	$6,267,088
2	2,999,514	2,821,610	3,650,871	2,883,399	32,448,183
3	1,522,017	1,941,455	1,764,477	1,748,998	19,756,925
4	626,957	831,603	829,834	822,554	9,336,208
5	414,228	430,567	429,651	425,882	4,847,866
6	277,130	288,060	287,448	284,926	3,248,071
7	112,745	117,192	116,942	115,916	1,319,496
8	97,131	100,962	100,747	99,863	1,135,049
9	60,829	63,228	63,094	62,540	706,973
10	51,465	53,495	53,381	52,913	595,315
11	34,452	35,811	35,735	35,422	398,213
12	23,808	24,747	24,695	24,478	274,245
Total	$6,725,313	$7,608,066	$7,715,005	$7,331,329	$80,333,631
LRs	0.943	1.061	1.069	1.014	0.948

SEMINAR FORMAT

EXHIBIT 12

LOSS RATIO SUMMARY

Reserve Data					
	9/89	10/89	11/89	12/89	Total
Method					
Res Ave	0.945	1.097	1.179	1.528	1.005
CCL	0.945	1.095	1.174	1.445	0.997
ModCL	0.944	1.066	1.188	1.365	0.988
MeanLR	0.939	1.044	1.040	0.973	0.940
Cred	0.943	1.061	1.069	1.014	0.948

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1. DeVylder, F., "Estimation of IBNR Claims by Credibility Theory," *Insurance: Mathematics and Economics* 1 (1982): 35-40.

2. Taylor, G. C., *Claims Reserving in Non-Life Insurance*, Insurance Series Volume 1. New York: Elsevier Science Publishing Co. Inc., 1986.

3. Taylor, G. C. and Matthews, T. J., "Experimentation with the Estimation of the Provision for Outstanding Claims in Non-Life Insurance," *Transactions of the Institute of Actuaries of Australia* 1977: 178-254.

known, are calculated separately. So that you could do exactly what you said without any trouble.

MR. STAEHLIN: Okay, so none of them depend on knowing when ultimate is reached.

MR. FUHRER: That's correct. The only thing that happens is that you can't estimate past the 12 months that the triangle is set up with, but you clearly could and you usually have more months of data. You usually have 24 to 26 months, and you could go ahead and do it all the way to the end of 36 months without much difficulty.

MR. ANDREW S. GALENDA: I'm wondering what the basis is for assigning credibilities to the loss ratio versus the chain ladder.

MR. FUHRER: If you read the paper by DeVylder, there were some assumptions made as to the variance in the claims by duration, and I believe that there was an assumption of normal errors and a least squares kind of credibility. The normal assumption is probably not very good, but it's probably not all that bad because of the central limit theorem. But if the reserves are optimum under these assumptions, then they may only be a little less than optimum for slightly different assumptions.

MR. ALAN N. FERGUSON: I would dispute your claim that seasonality is not a factor. I think it is still a factor. I think you get more claims in January. You get fewer claims in December, etc. I think you need to know what your claim payment patterns are. If your claim department is lagging behind, maybe it has had problems with the staffing, etc., although that can cause a disruption in your claim pattern.

I, too, haven't figured out all these formulas yet, but it seemed to me that you were stressing the difficulty of estimating the claims by the month of payment, rather than the month of incurral. It's the more recent months of incurral where you have very little data that are the most difficult to estimate, and there I find that the most satisfactory method is to try to develop claim costs by exposure, say, just as Mr. Lee was talking about, and try to project those for the more recent months of incurral. Now, as I said, maybe I haven't figured out what those formulas are.

The one final point is that you need to know what your definition of incurred is. Maybe for most group insurance it's all accounting to your deductibles, but if you're dealing with benefit period benefits where you're establishing a benefit period of maybe 3-5 years, you need to be sure that your claim people are totaling those correctly so that the claims are coded back to the dates when the benefits were actually incurred. That probably depends on your policy for durations whether you're stuck with a liability that may have been incurred several years ago and, in some cases, whether the group continues to pay premiums or not.

MR. FUHRER: I guess I agree that seasonality is somewhat of a problem. At least some of these methods could be adapted a little bit to that. For example, for the mean loss ratio method, you could calculate loss ratios for prior similar months or use your pattern to apply it to prior months and do it that way and still use the credibility method to average between the two sets of reserves. I don't know how to adapt this method for

different lengths of months due to the claim payment and number of days or lag, and I don't think those are unimportant. I agree with you. I think though that it's better to start with this method than some of the other ones and then make your adjustments based on that.

As far as your point about my emphasis on durational estimates, that was somewhat of a misunderstanding. I, particularly, was emphasizing that the importance of this method is in the most recent incurred month or the most recent couple of months, where the reserve factor methods, in this case, gave you ridiculously high answers because of only one month being paid. In this case, you want to use something that results from projecting loss ratios exactly as you said, but the problem was how much you should go in between the two methods, particularly, as you get back to one, or two, or three months prior. This method tells you how to do that. So your point is very well taken that the most recent months are the ones where we have the problem, and this method gives you at least some clue as to what you should be doing there.

MR. FERGUSON: I think it's better to project claim cost rather than loss ratios. Your premiums are changing.

MR. FUHRER: I completely agree with that. I feel that you could use premiums but you could also use exposures or you might not even want to use anything. You might want to just use 1 for premiums, or you might want to use some sort of inflated exposure where your trend inflates premiums so that you have some sort of real constant. I chose to call them premiums for this illustration only because I chose to call the ratios loss ratios. Some people might prefer to use premiums, because they may be a better estimate than some sort of assumed inflated exposures. I'm not advocating either method.

MR. JAMES E. DRENNAN: I'm going to talk primarily about the area of managed care and managing your bottom line through managed care. This includes both utilization and cost controls and how to measure them. Cost control is probably the most difficult.

Let's start with the history. Let's get a little context. Where are we? Where have we come from in managed care? The definitions can vary. I want to give you one that's in The 1988 *Record*, Vol. 14, No. 4A, P. 1712, "Effective Managed Care Design" by Howard Atkinson. He defined managed care as a comprehensive utilization review program that does the following. "It provides for preadmission, concurrent and retrospective review; is based on professionally recognized medical/surgical criteria; works with the attending physician in all cases. I think that's quite important; offers the patients and providers an appeal mechanism; and . . . has effective incentives/disincentives and provides for effective intervention and provider feedback . . . ." That's a complex term at the end, but basically, it's saying that you've to have the incentives and get feedback to know what's going on. That's really what we're talking about, how do you get that feedback, how do you know what's actually happening, and how do you measure it? We talk about managed care as making changes. We can change plan design. That was probably the initial stage. Most of the companies with which I've been associated did change the deductible, coinsurance, and maximums. They also reduced the mental and nervous

benefits from maybe 80-50% and limited the number of days covered. They made all sorts of plan design changes. These changes basically shifted the cost instead of addressing the underlying problem of controlling costs.

Our next phase was utilization control. There were some buzz words, such as, precept, weekend stay, concurrent review, discharge planning, second surgical opinions, outpatient surgery, case management. All these were thrown in at various levels and had various levels of effectiveness. I think we have found that some worked and some didn't. Another phase was cost control. In other words, we addressed the provider charge rates of the hospitals and the physicians. We started PPOs. We combined the PPOs with the managed care and got a complex conglomeration. We started HMOs. A lot of companies formed their own HMO subsidiary. We went into joint ventures. We formed exclusive provider organizations (EPO). We worked with fee discounts or schedules of reimbursements. All sorts of schemes were being used. Some worked, some did not.

What happened? What were the initial effects? The large discount was really not an effect but more an estimate that a lot of companies made. A lot of us were guilty. We got higher estimates of the reductions than actually resulted. I've seen some companies use in excess of a 20% discount for managed care. This was without any PPO or HMO controls. This was probably two or three years ago. I think nowadays you'll find no one would use a number that large for the typical managed care product. Instead they would use 4-6%.

We provided higher benefits. Many of the early PPOs had enhanced benefits. For instance, if you had an 80/20 plan, the PPO had 90/10. If you had a deductible, the PPO might have waived the deductible. The HMOs had almost no out of pockets. This was very common and I think it resulted in some problems. The result of some of this was a one-time dip. I've noticed in several large blocks of data that you can see that, when a total package was installed on a fairly reasonable and consistent block of business, there would be a drop in utilization. There would be a drop in the cost per contract, and it might be fairly substantial. The question is: Does it continue and show lower trends? I've seen mixed results on whether there are lower trends. I've seen some blocks that appear to have a lower trend rate, but I've seen quite a few that have basically the same level of trend just at a lower cost per contract than the nonmanaged care product. In other words, if you tracked your managed care versus your nonmanaged care products, they basically have the same trend but just at different levels. The question is why are they both going up just as fast? What have we not done effectively?

Let's talk about more recent times, the last two years. We've used more realistic discounts. Most companies have used a 4-6% discount for managed care. That's got to be carefully evaluated, because it depends on what went before. There are very few plans anymore that didn't have some controls already, so you can't give the same discount as if they had been nonmanaged. How effectively was it communicated? You can't use book numbers anymore. You have to look at each case individually. Now we often reduce benefits. I've seen a lot of the PPO plans have a reduction for the nonparticipating business. For instance, if your participating plan had an 80/20, the new plan has 80/20 if you go to the preferred provider and has 70/30 if you do not. It's a disincentive. The logic is that you tell employees, "Look, if you do what we're directing

you to do, you get the same benefits you've always had, the same deductible and the same coinsurance. Your out of pocket will be no more than before. But if you don't wish to go to the PPO providers, you will pay a little extra." I've seen a little bit of a swing towards these disincentive plans. The lower trends are mixed. We'll see some that have it and some that do not. The predominant benefit is now becoming some type of managed care.

I've found that the only plans that do not have managed care are negotiated plans where there has been union negotiations. Unions think that managed care is a negative. I'm very concerned that those plans are being selected against. I have a client that's like that. It's a self-insured plan. It's not a union, but it's a self-insured block, and it doesn't want to change to managed care. I think I finally convinced the client that it's in the minority and that its costs are just going out of sight. It is getting proposals for a PPO for the first time.

Flex plans is another term that can mean a lot of different things. I'm taking it to mean where you have multiple plans of health insurance for the employee to choose from, generally varying by deductible. The employees can select a low or high option plan. There may be some other things thrown in. It's not just a Section 125 Cafeteria Plan. I'm not sure that this does control cost. In fact, flex plan may, if not put in properly, increase costs. What we've seen some clients do is use flex plans to offset a reduction in benefits. A big employer will want to go in with lower benefits, therefore, it will use a flexible option to diffuse some of the criticism by offering options. It says to its employees, "You can take some of this money and get extra vacation days. You can opt out if your wife has coverage elsewhere." I feel that quite often flex plans increase the cost if not done properly. Now, there are techniques to avoid that but these are not part of our discussion.

Flex plans are really not a part of managed care, but they can be integrated with managed care. For instance, if you're bringing in an HMO option, then you should integrate that with your other plans and make it make sense. Employers have adopted networks. They've had their own networks. They've done national networks. There have been some joint ventures by commercial companies with the hospital chains. We've seen quite a few of those. Most of them are quite large. They're national in scope. You've got third party administrators. You've got utilization review organizations. Those are generally more regional in scope. You find, probably (I looked at a list the other day), that there's several hundred of them. They go from one city organization to regional and maybe a few that are national in scope. The employer networks are the newest thing that I'm finding the employer. They're pretty much being done out of dissatisfaction with the employer's current insurer. The employer doesn't feel like it is getting cost control. This is generally a large employer.

There's an example that you may have heard about, Allied Signal. Allied Signal put in a fairly significant plan with CIGNA as the carrier. I'll give you just a little bit of information that came out recently about the results of that. We're talking about doing things that work. Allied Signal feels like this is one that worked. This was a three-year guarantee by CIGNA that the cost would not go up more than 6-7% per year. During this period Allied Signal had another indemnity plan that experienced 18% increases per

year. So it felt like it had a pretty good comparison and that one plan was much lower than the other. Allied Signal's costs were 23% lower for employees than they would have been in the fee for service plan. Now, there may be some differences. I'm not sure if that was age adjusted and I can't tell you all the details, but this is what Allied Signal is maintaining. There's still about 19,000 employees who are under a collective bargaining agreement who are not in this plan. CIGNA commented that its profit margin on this, despite having its network costs below what it guaranteed, was less than 1% on this plan. I would say that that's a fairly small return for the large risk it took, but it was a very innovative plan and I think it gained CIGNA quite a bit of attention. So it may have been worth it for CIGNA. It's coming up for renegotiation and Allied Signal expects to renegotiate with roughly the same guarantees. There's no comment from CIGNA as to what it expects to renegotiate. I think that's an example of an employer network though that apparently was large enough to work and apparently kept the data fairly well.

I'm going to split this, as well as I can, to managing utilization versus managing costs. It will not be perfect because the two are interrelated, but for purposes of discussion I'll try to separate them. Some of the sources of saving on the utilization side are the sentinel effect. The sentinel effect being where the physicians and the hospitals know that they may be reviewed and so they have changed their practices. There's no way to know what that's worth. Reduced stays in the hospital may have resulted. I think we have to be very careful in looking at reduced stays, because what was the stay reduced from? Did the doctor overstate what he expected so he could negotiate down to the expected that he really wanted, and therefore, the doctor's happy, the utilization review firm is happy because it looks like it has reduced stays, and all parties have gotten what they wanted to begin with? You've paid the same you would have otherwise and you've given a reduced rate. I think reduced stays are very suspect.

Denied admissions are pretty concrete it seems like, but then you have to follow up and see what happened later. Did the person come back as an admission for a slightly different reason or a complication? Did the person come back for a larger claim later? So just looking at denied admissions is not in itself a definite answer that you really save costs. The outpatient side I think is commonly accepted to be a coming or already here problem. We basically worked harder on the inpatient side, assuming that outpatient was less costly. We shifted to the outpatient as much as possible and what happened? The outpatient costs went up faster. We now find that some outpatient services cost more than inpatient. We may have to start sending people back as inpatients to save money! It's very difficult to control costs after the fact. The physician may call when he's already decided to admit the patient into the hospital and for how long. I find very infrequently that a utilization review company organization or a Blue Cross Plan will disagree with a physician who's dedicated to putting that person in. He knows the patient. He knows the need. He can document it. So you have to put the physician somewhat on the risk for that, and we'll get into that subject later. That's really more in the cost area. We've got to put some cost implications there. Otherwise, you're fighting a battle and making the physician angry, making him against the system, and making him use different coding techniques such as raising his estimates so he can reduce them. There are all sorts of techniques, and it's very difficult to control from the insurer's side.

Having physicians on staff is very helpful. Having a good utilization review company is helpful.

How would you measure the savings from utilization? Well, there's several techniques. None of them are perfect. Let me say that very quickly. One way is to do an on-site evaluation. Some of the things that you might look at are first, the network management people: Are they equipped and do they have some experience? Second, the provider network: Does it have adequate coverage, is it sound and have fairly efficient providers? Third, what is the quality of the customer service? Does it treat patients like people and does it have high quality service? Fourth, the medical management: Does it have expertise and the resources to really control costs or is management just out there selling its services cheaper than anybody else? Fifth, how is the network's financial, does it have legal support, are is it really that strong, can its withstand lawsuits, can it defend itself, can it do things properly and can it follow its systems? Last, does the company make data available to you so you can know how well it is doing? In doing this some of our people have come up with an eighteen page questionnaire that shows you some of the things you can ask. I don't want to present that right now and I'm not suggesting that that's what you would want to do, but it just shows you the difficulty of evaluating any network.

Let's suppose you just wanted to look at the numbers. Suppose you had someone who could give you some decent data. There's an article written in *Business and Health* in December 1989, by Evelar and Kline, and they give a method, "How to Get Your Money's Worth From Utilization Review." I would recommend that you look at it. It's another technique, and they're basically going with looking at the denied days. They're saying that you look at the days that were denied by utilization review, the cost for the average day, and the cost of the review itself. You put all that together, and you find out whether you really saved any money. I have a comment. The data are pretty hard to get on denied days. You'd have to have a pretty good firm or use follow-up review. You could have a panel. If you wanted to look at surgical techniques, you could have a panel of surgeons who would review a sample of cases and find out what was the effectiveness. One thing using a panel doesn't do is it doesn't use denied days. It just uses those that were in the hospital and looked at how many of them were inefficient with not needed days. The other negative is you need at least a one-year lag. Where have we heard that before? I think Tim told us the same thing on our reserves. Getting any medical information quickly is very difficult. There's no quick and dirty method.

I want to recommend to you how you pay for the utilization review if you're using an outside firm. Most often it's paid on a cost per employee covered. That's the typical one I see. First, if you have fewer admissions or fewer reviews, then you're paying the same amount. Second, if you're rewarding the utilization review board, or a client, or a TPA for just doing the same as it has always done by paying it on all employees no matter how many it looks at, you're really giving it the wrong incentive. The better way seems to be to pay the reviewers per case reviewed, therefore, they will have more incentive to review all the cases possible. They won't let some go. You'll pay for what you're actually getting. So I think that's a good comment about getting your money's worth.

Shifting over to managing the cost side, some of the sources of savings are discounts. Most networks that I've seen have either a discount, a fee schedule, or some variation of these. Some of these variations might be a per diem arrangement. The negative is that that's usually based on a hospital average, and so you may overstate your costs. If you have a younger population, you don't need as many services. You may use a diagnostic related group (DRG). That's probably one of the best methods, but it's very difficult to administer. You have to really have some sophistication. You have to be able to watch the coding. Capitation is a common thing used in HMOs. That's probably a very good technique. You're shifting all of the risk to your provider, whether it's a hospital or a physician. Generally, it's the physician side. That sometimes is more risk than the provider wants to take, and so you really can't get too many to join your network if you're using all capitation so that all of the risk is on them. So some techniques in between have to be used. Sometimes you can shift gradually to a capitation. Generally, you'll find that, if there's a hospital that's very full, it won't mind going to capitation, because that helps its budget. That way it knows what it is going to get on a more steady basis. It is difficult if the provider is not doing well, to put it on the risk. The provider doesn't like capitation then. The provider likes to have a little bit more control.

The provider selection is essential, and I think that's where we need to focus in the future more. We must not just negotiate the rates, but evaluate who are the most efficient providers; leave out the expensive hospitals and the physicians who are not in touch with current technology, are overcharging, or doing too many tests; get data; and get good providers. The idea is to get quality with low cost. An alternative procedure is generally some combination of things. For instance, if you're getting a lot of outpatient costs, go to an agreement that pays the lesser of the outpatient or inpatient. You don't have to bear the risk then. The doctor can take his choice. You say you'll pay the lesser. Now, you've got to monitor that as with anything. Another technique is to have all your preadmission outpatient work negotiated with your inpatient hospital. For instance, if there's some lab work that's done before someone's admitted to the hospital, often the provider can shift some costs by running up costs for the lab tests. Then someone goes into the hospital for a short number of days. If you can negotiate all that together, you can control your costs. In other words, you're trying to prevent the shifting. That's the real technique.

Measuring savings from your costs is generally the same as measuring your utilization savings. It's pretty difficult to do one versus the other. One of the key techniques is to try to have a control group. In other words, have a similar group that's not in your managed care program, such as Allied Signal did. That's about the best way to measure it. Another way is just to look at your actual billed charges versus what you paid. If you knew you would have paid 80% of the billed charges before and you're paying a lesser amount, that gives you some idea of your cost savings. Most of the utilization review outfits will give you some type of a reduction. They like to show those savings, and I think there are some savings. You just have to evaluate how good they are and how they compare with what you're paying. For the calculation method, again, the Atkinson paper would apply. Basically, you want to try to measure the difference in cost times the number of procedures.

Let's give you another example on prescription drugs. This one is a coming abuser. This will be one of our future problem areas, I think. We've shifted a lot of people, a lot of our clients, to card plans where go in and pay a $5 out-of-pocket amount, and they don't have to file a claim. You get every little claim. You don't miss a single one. Utilization really goes up. In an actual case where we had a large unionized employer that had both Blue Cross and Blue Shield over forty-nine of the fifty states and, also, a commercial company. They were both doing parts of the coverage, so you had both types. The employer had just about everything you can imagine. It had a traditional plan that paid under the major medical. It had a preferred provider organization for prescription drugs. It had a card plan and a mail order plan. So I'm not sure I can think of another option it could have had. An evaluation was done on the traditional type of arrangement where you set a limit on what you'll pay equal to the average wholesale prices on prescriptions. If the pharmacist actually pays less, then he should charge you less. That's really a good faith arrangement. It does not work very well. That's the most common, but you really have to audit it. You have to do a lot of work to keep up with that, because generally you'll pay more than what you should. Another technique is to establish a discount off the average wholesale price. Let's say you take 90% of the average wholesale price and use that as a reasonable approximation. I've found that 90% will probably fly in most of the large pharmacies. Eighty-five percent will also go on most of the large ones, because large pharmacies don't pay full average wholesale price. They usually have some volume discounts. Now, your small pharmacies will have some problem with that, so you have to decide how your network should be structured and how far you want to go. But 85-90% is a reasonable range. You go down until you hear too many screams and then you stop. That's not a good technique, but that effectively is what happens. That is a better method than the good faith.

Generic drugs is where there's a lot of savings but, again, there are techniques to use and techniques not to use. In this particular case the client was using a maximum allowable charge for generic and had a list. If you used one of those drugs on that list and did not get the allowable change, you paid the difference. It was fixed. But what's interesting is one plan had 130 drugs on its list and the other had 260. The one with 260 was actually paying more for each of those drugs, but overall, it saved money because it had a larger list. So it's not just looking at a few of them, look at the whole picture. Your generic list should be as broad as you can reasonably make it to save yourself some costs.

Mail order drugs were the other part of this. We found that mail order drugs were saving money. Now, we didn't evaluate the wastage. There's a lot of wastage in mail order plans and you have to really watch that. You can have some people who will order three months of something and the doctor will change their prescription and they'll throw away two months of it and they get another three months. You have to really evaluate that. But the actual costs were lower and a couple of interesting things happened. There were two different states used. On this case I think it was Ohio and Pennsylvania. Ohio had a higher utilization of generic drugs than Pennsylvania. We investigated and Pennsylvania laws were much more restrictive. Pennsylvania would not allow the pharmacist to do as much. This is where the mail order was located. People were all over the country, but the mail order houses were one in Ohio and one in Pennsylvania. The recommendation was shift the business all to Ohio. Now, I'm not

saying that's going to be true in every case, but look at your state laws. Look at what's the effect of your mail order drugs, because they basically go by the state in which they're located. Are pharmacist allowed to substitute in every case?

One last thing on prescriptions, I don't want to beat this to death, but it's an excellent area that controls some costs. There are areas that have drug utilization review. This is basically a point where you review the appropriateness of drugs. Is the patient using something that's at too high a level or too low a level? Would it conflict with something else the patient is using? Well, we checked all the mail order drug companies that said they're monitoring this. We found that they'd use the current month's tape, and if it conflicted with anything else in that month, they'd kick it out. They did not go back and capture any prior month's data. So it was almost useless. So you have to evaluate whether the monitoring really does any good. You really have to watch the inappropriate prescriptions.

Those are some examples of how to evaluate some types of a cost control. The problem areas are pretty obvious. How do you estimate the shift, what would have happened if you had not done this, if you deny a procedure, if you move someone to another setting, how much did you save if you send the patient to outpatient, or what would the costs have been? That's difficult. Evaluating the savings due to shifting patients to a non-review procedure, such as outpatient, is a real problem.

Let's talk about the future, and some of this future really is now. For utilization review what I'm seeing is a shift to precertification of outpatient care. In other words, where we might have had a second surgical opinion required on certain items, now we have precertification. We require a person to call before he goes into an outpatient setting to determine the appropriateness. Is this really needed? If you do this, then there's no need for a second opinion, because you have gotten second opinion in your precertification. This is being done by several large carriers right now. Now, I'm sure that there will be a shift somewhere else, so you need to stay ahead of the game.

For psychiatric and substance abuse I'm seeing an unbundling of services to get physicians that have the special knowledge. In other words, you can't use just a general utilization review firm that has general medical practitioners. You've got to have some specialists in psychiatric and substance abuse review. We're finding a lot of specialty firms where that's all they do. You may, unbundle, that is pay one firm for one type of review and another firm to do another type. You may at your company or your Blue Cross Plan have specialists. Unbundling is where things are going. For chiropractic reviews, I've seen specialists. They have a special plan to evaluate chiropractic care, if you cover that, and it's hard not to cover it. In most states it is mandated that you cover chiropractic care under some form. Complete episode review means looking at the case from inception or prior through the discharge and after. For instance, for rehabilitation and skilled nursing facilities you try to keep that person from coming back in for another admission by giving the appropriate care for the entire period.

Tailoring is similar to unbundling. This is not getting tailored for a new suit. This is getting tailored for your plan. Let's say you have an employer that had a high number of female employees. Does it need the same utilization review as another firm with all

50-year-old males? Probably it does not. You need to tailor it. One will need more maternity care, review that. One will need more cardiovascular type services. You really need to tailor your procedures to your client, and that will keep them happy with you and keep your costs down. What do I see happening in the future on cost savings? I see an emphasis on the large claim. The small claims seem to be very well managed. There's not a lot more savings to be had. The real dollars are in the large claims. These are the MRIs, CAT scans, transplants, AIDS claims, prenatal claims, etc.

Expanding of networks: I think we will have fewer and fewer of these small local networks. I think the carriers are going to demand consistency and some expertise. I think there will be some shifts between providers. This is basically between the physician groups, and I think it's already started with the Medicare changes. Medicare is basically forcing a shift in costs from specialists to general practitioners. I think we're going to see that. If we don't react to it, then we're going to bear the brunt of that shift.

In the future what type of networks are we going to see? Point of service is already the hot buzz word. If you don't have a point of service, then you're not in. A point of service is probably different for different people. In my opinion, it eliminates some of the controls. It allows the employee to choose more frequently, thereby eliminating some of the cost savings you would have had. I would say that that's somewhat of a negative. However, it's probably more controlled than your old fully nonmanaged networks.

HMO lookalikes: I've seem some people come out with a benefit plan that pays everything (with maybe a $5 copayment), and they say this will compete with the HMOs. Well, it will. It will sell quite well, and the costs will sky-rocket. So I think you have to be careful of those. We'll have fewer players. I think the trends we're seeing now where CIGNA and Equicor are going through some sort of a conglomeration will continue. I think the smaller players are going to have difficulty. I think we're going to see these networks extend. Comprehensive doesn't mean a comprehensive plan. It means a comprehensive type of a network that's going to cover all the employees and as much of their costs, inpatient and outpatient, as possible. I think we'll find that HMOs, and PPOs and point-of-service (whatever they are, PPOs, I guess) will all sort of blend, and we're going to have difficulty in distinguishing one from the other. I think that only those that are efficient will survive. It's not going to matter what they're called. We're going to lose the identification of acronyms, but we're going to find that the efficient ones are going to survive, and those are whom the employers are going to stay with no matter what they're called. Quality is going to be one of the biggest concerns. How do you measure it? Do you look at the success rate of a hospital or how successful it has been in heart transplants?

Do we look at not only their costs, but also their quality, such as do they have repeat admissions? If we don't emphasize the quality, I think some of these lawsuits about inappropriate care or people being denied care are going to come back, and we're going to start really paying some costs after the fact. I think there will be more and more lawsuits by people who have been denied care. So if you don't work with a really quality organization or internally have your own quality standards up, I think you're going to be in trouble. That's a real emphasis that I think you need to make. Last, education is

important. This means education of your own staff and education of employers and groups that purchase from you. Wellness programs have been used. There's mixed feelings as to their effectiveness, but I still think they are going to be emphasized, and they'll be predominant. Employee assistance programs will tend to overemphasize inpatient care, and you have to really watch that, but overall, I think they will be effective and most important. Communication programs, of course, are needed internally and externally. There's a general feeling that we need to be changing.

Let me tell you a little story about how it's not as easy as you might think. There was a farmer who came into the big city. He hadn't been there in years and he brought the family, including ma and the kids, with him, and they went into the shopping center and he was just amazed. He saw this crowd of people around a door, so he went to look at it. The door opened, people got in, the door closed and they were gone. He said that that's amazing. Where did those people go? He came back, opened it, and there's was no one there. Well, in the crowding there was this little old lady who got crowded out, so she went to the next door (the next elevator). So he watched and as she got in she kind of tottered. The door closed. Then pretty soon it came down, and sure enough, there was this young woman who walked off. He was thinking, my goodness, and he turns to his kids and says, "Kids, go get ma. We're going to try this machine one time." So I think our desire to change cannot be as wide-eyed and innocent as that. We've got to look at it realistically, and when everyone else is doing something, we should be moving on to something new.

MR. FUHRER: I don't have any neat stories about shopping centers, so you'll have to tell your own jokes later, I guess. In the Appendix to this presentation, there is some text. I included that because I have submitted it to the Health Section newsletter. It is essentially a write up of what I'm going to talk about in a slightly more simplified form. So you can look at that later, or you can wait until the newsletter comes out.

Here is a little bit of background. What I'm talking about is how we go about renewing cases or, for that matter, rating new cases when we have experience. There is a method that's used by most of the health actuaries, at least for groups over 25 lives (but often for smaller ones) and under 200 and maybe up to 500. This is called the credibility method. By that I mean that we have manual rates and we have experience rates for the group, and we use a weighted average between the two. The percent that we use for the group's own experience (versus the manual rates) is called the credibility percentage. I don't know if people realize how important the credibility percentage is. It seems to me that maybe the importance may be underestimated. If you use credibility percentages in your rating that are too high (which I believe is probably not the problem, but it may happen), then you will end up overcharging for the groups with higher claim experience. Somebody else will write these groups. On the groups with low claim levels in their experience groups, you will undercharge. Presumably, in the competitive environment, you will then write these latter groups, and you will lose money. The same thing in reverse happens if your credibility is too low; on the groups with high claim experience, you will be undercharging. You will write those groups, and you will not write the groups that you're overcharging that have better than expected experience. This latter case is more common and leads to a situation where you then redo your manual rates based on your own block of experience (which has more high claim experience groups),

and you find that your manual rates themselves are then not competitive. Then you don't exactly know what to do when your marketing person says you can't sell anything with these manual rates. You have to lower them. You dig out the experience on your block of cases and say, "No way, my experience proves that you're wrong. Those companies are low balling to get the business and will continue to have a shrinking market because I'm right." Well, you may be getting all of the groups with poor experience in your block, and you don't have any way out of that except assuming that because you've been selecting for those poorer groups, that you're going to have to just lower your manual rates below what your block's experience shows. Actuaries in general have not liked to do this sort of thing. Anyway, since I considered it important, I developed some formulas for determining the credibility of group health insurance experience. The formulas appeared in my paper on credibility which was in the most recent *Transactions* (Volume XL, 1989). The paper was somewhat on the mathematical and theoretical side and I think to some extent it was, therefore, ignored. I'm going to present some of the things that were in the paper with a little more of a numerical or practical approach.

As such, my presentation is quite similar to the short article for the newsletter. First, let's talk in general about what we mean by credibility. Some of this may be review for some people, but I think it's interesting. Let's assume that we have the random variables X_1, and X_2. One and two here will refer to consecutive years, although it could be consecutive months, centuries, or whatever you like. But the point of the whole thing is that we have some claim data in those years for a whole block of cases, and now we're faced with the problem that we have claim experience in year two on one case, and we want to try and find out what to do about rating for year three on that one case. It stands to reason that we should look back at years one and two and determine how we would have renewed our block at the end of year 1, knowing what we do now about what happened in year two. My whole approach is to try to answer that question. Then I'm going to assume that whatever we should have done at the end of year one, we should now follow the same procedure at the end of year two. So we're going to assume that we can approximate the claims in year two by a constant Z times year one's claims plus another constant C. If you solve for Z and C, using least squares, then you find that Z (which we call the credibility) is equal to the covariance between X_1 and X_2 divided by the variance of X_1. Of course, the constant C is really just one minus the credibility times the expected or manual claims. This formula is proved in a number of exam number 110 texts, (although some did not). When we start talking covariance and variance, it sounds all statistical and complicated, so we don't really feel very good about it. So I decided I might as well mention a couple of intuitive explanations of this particular formula.

The first explanation requires you to remember that the correlation coefficient sometimes called Rho, was merely equal to the covariance between two random variables, divided by the square root of the product of their variances (or the product of their standard deviations). Rho is a measure of how much the two variables hang together. Well, of course, Z, here, is almost the same as Rho except we're using the variance of X_1 instead of the average, the geometric average, if you like, of the two variances. So it really is just a correlation coefficient. In fact, Z and Rho will be the same if the variances are the same. Incidentally, this provided me with an answer to one problem

that bothered me for a couple of years. The problem is in the situation where you have a 100% credibility. Maybe in group health the credibility is 100% at 200 lives or at 1,000. One of the things that you might remember from statistics is when your correlation coefficient is exactly equal to one, then there's no more residual variance in the prediction of the dependent random variable (the second year). You can predict exactly what's going to happen from one year to the next. They're 100% correlated. I know of many groups that I think should have a 100% credibility, but I don't think that we know exactly how many claims those groups are going to have before the year. The answer is that Z can be equal to 1, but the correlation coefficient can be less than 1 if the variance in the second year is greater than the first year. So if you assume that the variance goes up from year to year (which may result from more ways to practice medicine, or maybe because there's trend going up) the problem goes away.

Now I want to give a second intuitive explanation of the formula for Z, Let X'_1 equal X minus the expectation of X, the deviation of X from its mean. Then the covariance is just equal to the expectation of the product of X'_1 and X'_2, and the variance is the expectation of X'^2. We can see that Z is then merely the weighted average of X_2 divided by X'_1. See Exhibit 13. If you want to know what your experience for a group is going to be next year, why not take last year's claims and multiply that amount by the average ratio of one year's claims to the prior year's claims? That's all we're doing here.

Z equals a weighted average of the ratios. This is a nice intuitive explanation, but none of the books I've read on credibility or the papers have mentioned it. With these concepts we're going to estimate the credibilities for a set of groups. I'm going to introduce a little bit of notation here. Let $X_{i,t}$ be the total of group i's mean adjusted loss ratios (RDMs) in year t. See Exhibit 13. I have some data with me. I have some examples from the data on Exhibit 14, so you can see how we developed these things. More of the data are in Exhibit 15, and the totals are in Exhibit 16. I should warn you that I made these data up. They are completely a figment of my imagination, but I made them up to illustrate some points. I did get similar results at least once from some claim data that I had at my company a few years ago, and that was at the end of the paper that was in the *Transactions*, so it's not entirely phony.

In Exhibit 14 each line is for an individual. There are ten individuals in the first group. The group totals are shown. We have premiums and claims. These are individual premiums, and it's worth pointing out that I know in group insurance we don't usually develop individual premiums, but we could infer what they might be from our manual rates. These are manual premiums. We have age adjustment factors which I applied to the base manual rates. When I talk about individuals, that may be a misuse of the word. At least, when I did this for my paper, I called employees individuals and composite dependents were also individuals. That is, I added all the dependents in a family together into one composite individual. You can do it any way you want as long as you're consistent; that is, you analyze the data the same way as you apply the credibility. If you've got data down to the individual member dependents, you could do it that way, or you could go the other way and include the employees into composite families. We have the premium and the claims, so we calculate loss ratios and then we subtract the average for the whole year from these loss ratios and that gives us the RDMs. For example, the total RDM for group number 1 is 6.246 in year 1, and for group number 2

SEMINAR FORMAT

EXHIBIT 13

CREDIBILITY

Random Variables: X_1 and X_2

Assume: $X_2 \approx ZX_1 + C$

Least Squares: $Z = \text{Cov}(X_1, X_2)/\text{Var}(X_1)$ and $C = (1-Z)E(X)$
z is called the credibility.

Intuitive Explanations:

1. $$Z = \frac{COV(X_1, X_2)}{Var(X_1)} = \frac{Cov(X_1, X_2)}{\sqrt{Var(X_1)\,Var(X_2)}} = \text{Correlation Coefficient } (\varrho)$$

2. $Let\ X' = X - E(X)$

Then $$Z = \frac{Cov(X_1, X_2)}{Var(X_1)} = \frac{E(X'_1 X'_2)}{E(X'^2_1)} = \frac{E\left[X'^2_1 \frac{X'_2}{X'_1}\right]}{E(X'^2_1)} = Weighted\ average\ of\ X'_2/X'_1$$

Estimation of Z (Group Data)

Let $X_{i,t}$ be the total of Group i's, mean adjusted, loss ratios (RDM) in year t.

Examples: (Simulated Data): $X_{1,1}$ + 6.246, $X_{2,1}$ = -1.3188, and $X_{2,2}$ = -1.0443.

EXHIBIT 14

			Year 1					Year 2				
Grp	Ind	Prem	Claims	LR	ROM	ROM^2		Claims	LR	ROM	ROM1 x ROM2	
#	#					Ind	Grp				Ind	Grp
1	1	$1,800	$1,898	1.054	-0.077	0.006		$1,878	1.043	-0.102	0.008	
1	2	1,800	3,033	1.685	0.553	0.306		2,561	1.423	0.278	0.154	
1	3	1,840	9,992	5.431	4.299	18.484		4,094	2.225	1.080	4.644	
1	4	1,590	3,148	1.980	0.848	0.720		2,553	1.606	0.461	0.391	
1	5	2,860	1,720	0.601	-0.530	0.281		3,134	1.096	-0.049	0.026	
1	6	1,840	1,197	0.651	-0.481	0.231		2,669	1.451	0.306	-0.147	
1	7	1,480	1,046	0.707	-0.424	0.180		1,685	1.138	-0.007	0.003	
1	8	1,590	1,676	1.054	-0.078	0.006		2,589	1.628	0.483	-0.037	
1	9	2,430	9,271	3.815	2.684	7.204		4,091	1.683	0.538	1.445	
1	10	1,590	926	0.582	-0.549	0.301		1,954	1.229	0.084	-0.046	
1	Tot	Inds 10	Inds^2 100	17.560	6.246	27.718	39.018		14.522	3.07245	6.440	19.192
2	1	2,120	1,453	0.685	-0.446	0.199		1,811	0.854	-0.291	0.130	
2	2	2,860	2,150	0.752	-0.380	0.144		1,886	0.659	-0.486	0.184	
2	3	3,490	3,355	0.961	-0.170	0.029		3,963	1.136	-0.009	0.002	
2	4	1,800	4,873	2.707	1.576	2.484		2,713	1.507	0.362	0.571	
2	5	2,120	1,326	0.626	-0.506	0.256		1,471	0.694	-0.451	0.228	
2	6	4,550	2,382	0.523	-0.608	0.370		2,600	0.571	-0.573	0.349	
2	7	3,490	2,043	0.585	-0.546	0.298		2,264	0.649	-0.496	0.271	
2	8	2,120	3,424	1.615	0.484	0.234		2,406	1.135	-0.010	-0.005	
2	9	1,590	1,553	0.977	-0.154	0.024		2,245	1.412	0.267	-0.041	
2	10	1,840	1,035	0.562	-0.569	0.324		3,289	1.788	0.643	-0.366	
2	Tot	Inds 10	Inds^2 100	9.994	-1.3188	4.360	1.739		10.405	-1.0443	1.323	1.377

SEMINAR FORMAT

EXHIBIT 15

			Year 1					Year 2				
Grp	Ind	Prem	Claims	LR	ROM	ROM^2		Claims	LR	ROM	ROM1 x ROM2	
#	#					Ind	Grp				Ind	Grp
1	1	$1,800	$1,898	1.054	-0.077	0.006		$1,878	1.043	-0.102	0.008	
1	2	1,800	3,033	1.685	0.553	0.306		2,561	1.423	0.278	0.154	
1	3	1,840	9,992	5.431	4.299	18.484		4,094	2.225	1.080	4.644	
1	4	1,590	3,148	1.980	0.848	0.720		2,553	1.606	0.461	0.391	
1	5	2,860	1,720	0.601	-0.530	0.281		3,134	1.096	-0.049	0.026	
1	6	1,840	1,197	0.651	-0.481	0.231		2,669	1.451	0.306	-0.147	
1	7	1,480	1,046	0.707	-0.424	0.180		1,685	1.138	-0.007	0.003	
1	8	1,590	1,676	1.054	-0.078	0.006		2,589	1.628	0.483	-0.037	
1	9	2,430	9,271	3.815	2.684	7.204		4,091	1.683	0.538	1.445	
1	10	1,590	926	0.582	-0.549	0.301		1,954	1.229	0.084	-0.046	
		Inds	Inds^2									
1	Tot	10	100	17.560	6.246	27.718	39.018		14.522	3.07245	6.440	19.192
		Prem	Claims									
2	1	2,120	1,453	0.685	-0.446	0.199		1,811	0.854	-0.291	0.130	
2	2	2,860	2,150	0.752	-0.380	0.144		1,886	0.659	-0.486	0.184	
2	3	3,490	3,355	0.961	-0.170	0.029		3,963	1.136	-0.009	0.002	
2	4	1,800	4,873	2.707	1.576	2.484		2,713	1.507	0.362	0.571	
2	5	2,120	1,326	0.626	-0.506	0.256		1,471	0.694	-0.451	0.228	
2	6	4,550	2,382	0.523	-0.608	0.370		2,600	0.571	-0.573	0.349	
2	7	3,490	2,043	0.585	-0.546	0.298		2,264	0.649	-0.496	0.271	
2	8	2,120	3,424	1.615	0.484	0.234		2,406	1.135	-0.010	-0.005	
2	9	1,590	1,553	0.977	-0.154	0.024		2,245	1.412	0.267	-0.041	
2	10	1,840	1,035	0.562	-0.569	0.324		3,289	1.788	0.643	-0.366	
		Inds	Inds^2									
2	Tot	10	100	9.994	-1.3188	4.360	1.739		10.405	-1.0443	1.323	1.377

			Year 1					Year 2				
Grp	Ind	Inds 10	Inds ^2 100	LR	ROM	ROM^2		Claims	LR	ROM	ROM1 x ROM2	
#	#					Ind	Grp				Ind	Grp
3	Tot	10	100	12.898	1.585	6.947	2.513		10.998	-0.4514	2.167	-0.716
4	Tot	10	100	7.242	-4.072	1.917	16.578		8.819	-2.6309	1.091	10.712
5	Tot	10	100	11.188	-0.125	4.783	0.016		9.139	-2.3108	1.316	0.289
6	Tot	10	100	7.309	-4.004	2.007	16.033		9.584	-1.8653	1.023	7.469
7	Tot	10	100	13.236	1.923	13.977	3.698		16.391	4.94101	2.942	9.502
8	Tot	10	100	8.158	-3.155	1.662	9.957		10.185	-1.2644	0.719	3.990
9	Tot	10	100	9.178	-2.136	2.128	4.561		11.696	0.24666	-0.386	-0.527
10	Tot	10	100	13.730	2.416	15.458	5.838		12.801	1.35099	2.298	3.264
11	Tot	10	100	7.001	-4.312	2.058	18.597		11.055	-0.3946	0.091	1.702
12	Tot	10	100	49.818	38.505	842.2	1482.6		28.8	17.3698	249.5	668.829
13	Tot	10	100	8.122	-3.191	1.599	10.184		10.919	-0.5309	0.408	1.694
14	Tot	10	100	7.838	-3.475	1.931	12.077		7.500	-3.9496	1.916	13.726
15	Tot	10	100	7.895	-3.418	1.612	11.682		7.960	-3.4894	1.329	11.927
16	Tot	10	100	11.674	0.361	10.444	0.130		10.394	-1.0552	6.471	-0.381
17	Tot	10	100	10.723	-0.590	5.287	0.349		8.963	-2.4865	1.365	1.468
18	Tot	10	100	9.997	-1.317	5.117	1.734		8.959	-2.4911	1.788	3.280
19	Tot	10	100	7.820	-3.494	1.770	12.207		9.005	-2.4442	0.710	8.540
20	Tot	10	100	9.270	-2.044	6.211	4.176		8.988	-2.4615	1.958	5.030
21	Tot	10	100	10.386	-0.928	6.409	0.861		13.837	2.38725	1.034	-2.215
22	Tot	10	100	7.375	-3.939	2.845	15.512		8.604	-2.8456	1.057	11.208
23	Tot	10	100	12.983	1.670	8.526	2.788		11.3	-0.1320	1.9	-0.220
24	Tot	10	100	19.911	8.597	133.756	73.915		14.122	2.67223	31.112	22.974
25	Tot	10	100	12.712	1.398	15.516	1.956		11.191	-0.2582	4.416	-0.361
26	Tot	10	100	8.460	-2.853	1.579	8.142		10.534	-0.9156	-0.069	2.613
27	Tot	10	100	7.975	-3.338	1.818	11.142		13.735	2.28572	-2.159	-7.630
28	Tot	10	100	9.517	-1.797	2.372	3.228		9.226	-2.2237	0.667	3.995
29	Tot	10	100	7.238	-4.075	1.912	16.604		9.648	-1.8017	0.686	7.342
30	Tot	10	100	7.429	-3.884	3.106	15.087		7.342	-4.1075	2.167	15.955

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 16

				Year 1			
				LR	ROM	ROM^2	
Size	#Group	Inds	Inds^2			Ind	GRP
10	30	300	3,000	344.64	5.24	1,137.0	1,803.0
20	15	300	6,000	315.25	-24.15	232.6	228.0
30	10	300	9,000	358.31	18.91	677.3	645.3
Total	55	900	18,000	1018.20	0.00	2,047.0	2,676.2

				Year 2	ROM1 X		
				LR	ROM	ROM2	
Size	#Group	Inds	Inds^2			Ind	GRP
10	30	300	3,000	336.66	-6.83	325.27	824.0
20	15	300	6,000	347.54	4.06	69.49	48.2
30	10	300	9,000	346.26	2.77	203.86	351.9
Total	55	900	18,000	1030.47	-0.00	598.63	1,224.1

it's -1.3188. For group 2 and year 2, it's -1.0443. So these are what the data look like. I had no problem making up data. Exhibit 14 also includes a few more columns. We have the squares of the individuals' RDMs for year 1. The total of these squares was 27.718 for group number 1. The next column is the square of the group's total RDMs in year 1. This was 39.018, which equals 6.246 squared for group number 1. Analogously we also have the product of the two years of each individual's RDMs, which totals to 6.440 for group number 1 and the same product for the group totals, which for group number 1 is 19.192 (which equals 6.246 times 3.07245). The totals for each column are summarized in Exhibit 16. Exhibit 17 illustrates the calculation of the credibility for each size group using group totals. We just divide the two-year products by the first-year squares.

So the credibility for ten-life groups was 45.7%, for 20-life groups, 21.1%, and for 30-life groups, 54.5%. Now, if that strikes you as a not very good pattern, I'm not surprised. These probably should get larger as the group gets bigger. If you search through the data, you probably will find that there was one group in this block that had real good experience one year and not so good the other year, and that pulled the credibility down for 20-life groups. This is a problem with doing it this way. In fact, I think that most companies, if they try to do this for each size group, would get even stranger answers. In fact, I don't know how many groups you have that have exactly 200 and 13 individuals in it? I don't know. We have a big company and we probably have at least three or four groups. So you're not going to get good answers that way. Then you can start trying to combine groups that are about the same size. For example, use the value for all groups between 250 and 300 lives, and call that the value for 275 (better would be the actual average size of these groups) and then start interpolating. There are all kinds of great ways to do interpolations. Of course, if you're at a really big company, maybe there is no problem. This group method is essentially the one that was used in the Margolin paper, which was in the *Transactions* back in the 1970s but is still on our syllabus for exam number 422.

There's another problem which I also mentioned in that newsletter article. There are individuals in the groups, and you could rate each individual separately. Presumably, the group premium would be just a sum of all the individual premiums. So you certainly wouldn't want your individual credibility to be any more than the group credibility. So how much credibility do we have just on an individual's claim experience? Well, it should be possible to use the same formula except use the individual RDMs. The answer for the data is calculated in Exhibit 18 and equals 29.24%. I've found that, every time I've looked at claim data, the percent correlation between years for individuals is always in the twenties. I believe that this is what it should be.

There is a simple explanation. People who go to the hospital and have high claims one year tend to do it again the following year. They may have chronic conditions. People who are healthy and don't go to doctor at all are more likely to be healthier than the average person. Twenty-nine percent doesn't seem all that out of line. This is a little surprising to some people. Most of the group actuaries think that when you get under 20 lives in a group, the credibility of its experience would be 0. The individual actuaries should not be surprised by this. Why do they underwrite applicants for individual health insurance if you can't tell anything about a person's health from his history?

EXHIBIT 17

Then:

$$\hat{Z} = \frac{\sum_{i=1}^{n} X_{i,1}X_{i,2}}{\sum_{i=1}^{n} X_{i,1}^{2}}.$$

$\hat{Z}(10) = 824.0/1803.0 = 0.457$
$\hat{Z}(20) = 48.2/228.0 = 0.211$
$\hat{Z}(30) = 351.9/645.3 = 0.545$

EXHIBIT 18

INDIVIDUAL CREDIBILITY

Let $X_{i,g,t}$ = Individual i's (who is in group g) mean adjusted loss ratio (RDM) in year t and n_g = the number of individuals in group g.

Examples: $X_{1,1,1} = -0.077$, $X_{2,1,2} = 0.278$, and $n_1 = 10$.

$$\text{Then } \hat{Z}(1) = \frac{\sum_{g}\sum_{i=1}^{n_g} X_{i,g,1}X_{i,g,2}}{\sum_{g}\sum_{i=1}^{n_g} X_{i,g,1}^{2}}$$

$$\text{So } \hat{Z}(1) = 598.63/2047.0 = 0.2924$$

People's claim history tells you quite a bit about their health. I don't know if I'd want to use only claim experience to underwrite people for individual health. Somebody might be sick and know it and hasn't been to the doctor, but claims do tell much more than nothing. So the 29% is a minimum for the 1-life group. So how do we put these two together and at the same time solve the problem of the fact that we can't take these different size groups and put them together? We need a formula by size of group. In the literature, there is a formula in which credibilty equals n divided by the quantity n plus k.

Here k is a constant and n is the breadth of the exposure. In Exhibit 19 we see that, using the value of 45.7% for the credibility of a 10-life group, we can solve for k in this formula. Using this value of k the credibilty for a 1-life group would equal 4.57%, which is too low. The problem is that this formula was not derived for group health insurance and just does not work. Also in Exhibit 19, item 2, I present the correct formula for credibility by size of group. In the *TSA* XL paper I show that with very minor assumptions, that this is the correct formula for group insurance using the least squares criteria. So it has some theoretical justification.

There are also in Exhibits 19 and 20 two formulas for calculating the parameters k_2 and k_3, from the data. Exhibit 21 has the resulting credibility for the data. These estimators of K_2 and K_3 suffer from some of the same problems that you would have when you start estimating the credibility for a particular size of group. One group with unusual experience can have a large effect on the answer. It is a little better than the other method, because you put all the groups together to get your answer. So it's not going to give you strange answers quite as often. When I did this work for the paper I collected some data at my company. I had the experience of about 30,000 people in groups that varied from about 10-120. If you look at the end of that paper you'll see the results. In the text of the health newsletter article, I simplified my formula a little bit. I had k_2 and k_3 be the same, and I gave the estimation formula for k_3. I really don't know what answers would be obtained for the k's at various companies. It seems to me that this is one of the types of data that the Society of Actuaries should collect as part of the experience studies. I have so suggested to the Committee on Research Policy. Companies would only have to contribute total dollars of claims or loss ratios on a person by person basis without names over two years. We could call this a health insurance credibility experience study.

My paper includes a number of other topics. The methods presented here assume that nobody leaves the group. The paper derives formulas to adjust for turnover from the group. The methods used here were simplified to ignore the differences in premium within the group (except in estimating the parameters). There's a formula in the paper to properly adjust for different size premiums. The paper has a formula for the credibilty of a group's experience on its specific stop loss rates. Finally, I even derived optimum pooling points for prospective rating. I hadn't seen any method for calculating these. I'm doing some more work with this. One of the things I did not do in the paper was analyze the effect of multiple years of experience. This would try to answer the question of how much experience you should use in rating.

MANAGING THE BOTTOM LINE -- GROUP EXCLUDING METS

EXHIBIT 19

COMBINING INDIVIDUAL CREDIBILITY TO GROUP CREDIBILITY

1. Wrong Way:

$$Z(n) = \frac{n}{n+k} \quad \textit{and therefore:} \quad k = \frac{n-n\hat{Z}(n)}{\hat{Z}(n)}.$$

$$= $$

$$k = \frac{10-\hat{Z}(10)}{\hat{Z}(10)} = \frac{10-0.457}{0.457} = 20.88.$$

This leads to Z(1) = 0.0457, which is too low.

2. Correct way uses formula:

$$Z(n) = \frac{k_1+(n-1)k_2}{1+(n-1)k_3} \quad \textit{with } \hat{k}_1 = \hat{Z}(1),$$

$$\hat{K}_2 = \frac{\sum_g \left[\sum_{i+1}^{n_g} X_{i,g,1}\right]\left[\sum_{i-1}^{n_g} X_{i,g,2}\right] - \sum_g \sum_{i=1}^{n_g} X_{i,g,1}X_{i,g,2}}{\left[\sum_g n_g^2 - \sum_g n_g\right] \dfrac{\sum_g \sum_{i=1}^{n_g} X_{i,g,1}^2}{\sum_g n_g}}$$

$$= $$

$$= $$

$$= \frac{1224.1 - 598.63}{(18000-900)(2047.0/900)} = 0.0161$$

EXHIBIT 20

$$\text{and } \hat{k}_3 = \frac{\sum_g \left[\sum_{i=1}^{n-g} X_{i,g,1}\right]^2 - \sum_g \sum_{i=1}^{n_g} X_{i,g,1}^2}{\left[\sum_g n_g^2 - \sum_g n_g\right] \frac{\sum_g \sum_{i=1}^{n_g} X_{i,g,1}^2}{\sum_g n_g}}$$

$$= \frac{2676.2 - 2047.0}{(18000-900)\ (2047.0/900)} = 0.0162$$

EXHIBIT 21

Estimates: $k_1 = 0.2924$, $k_2 = 0.0161$, and $k_3 = 0.0162$.

n	$\hat{Z}$
1	0.292
5	0.335
10	0.382
20	0.457
30	0.516
50	0.603
100	0.724

MS. DOROTHEA D. CARDAMONE: I'd be interested in knowing what results you got for the specific stop loss in terms of credibility when you compare it with Exhibit 21 that you just showed us. Is it very different? Also, what about other types of coverage? I'm assuming you were doing a basic comprehensive plan, but what about supplemental major medical, and would you take that into consideration when you're doing the credibility that you just developed?

MR. FUHRER: The answer to the last question is that I have done nothing with anything else but broad comprehensive medical coverage. I think the same type of analysis would work very well with any of the other types. You might want to keep them separate. I have a hunch that hospital only might give you about the same level of answer. I think dental would be very interesting, but who cares about dental anyway?

MS. CARDAMONE: Dental actuaries.

MR. FUHRER: Right, well, I can get my teeth into that. Sorry. About specific stop loss, first let me repeat that I'm not calculating the credibility of the stop loss claim experience; I figured that for small groups you wouldn't have much experience. So I'm merely calculating the credibility average between the percent of expected claims method versus percent of manual method. So before I even say anything, I hope that's understood. Is it understood?

MS. CARDAMONE: No.

MR. FUHRER: Companies generally have two ways of pricing specific stop loss. One way would be to look at their claim cost table by deductible and estimate that the price for specific stop loss at, say, a $50,000 attachment point would be $2.35 per month for a 40-year-old male. Then the rate would be adjusted for different ages and gender. I call these the manual rates. Then other companies, and this is probably more common, would estimate that claims over $50,000 comprise 2.1% of all claims. So they would estimate the specific stop loss claims for a $50,000 attachment point as 2.1% of the group's total projected claims (both above and below the $50,000). I'll call this the experience rate. The credibility factors that I derive in the paper for specific stop loss are for the weight to give to the experience rate versus the manual rate. When I did that I found out what happened was that k_2 got smaller with the size of the specific attachment point. So what happens is, as the group gets bigger, this credibilty does not approach 100%. Instead it is limited to the ratio of k_2 to k_3. If you wanted to get the credibility of the specific claim experience on specific claims, you could use the same methods as for regular medical claims shown above. I did not do this.

MS. CARDAMONE: Well, I just hope you will publish some of what you're doing on the stop loss. If you've got it available, I think that would be of interest to other people, too.

MR. FUHRER: The specific stop loss is in *TSA* XL paper.

MS. CARDAMONE: Okay, good.

MR. LEONARD KOLOMS: Chuck, since part of this session is managing the bottom line, maybe you could talk about the practicality of using your figures. I'm thinking about the fact that, after you published your paper, our company took a look at it and found that your credibility factors were substantially higher than the ones we were using. But we also came to the conclusion, if we adopted your credibility factors, we'd lose money because we would increase the credibility that we'd be giving to the groups with the good experience, charge lower rates, and would still renew those groups. The groups with the bad experience would have higher rates, and we still wouldn't renew those. The results would be that we would keep roughly the same groups with less premium. Could you comment on that?

MR. FUHRER: All right. My first comment is something that I mentioned before. If, indeed, the credibility that you're using now is too low, you will be losing money. That is, you probably already have a block of poorer groups. This is because the better groups probably have already gone to another company that gave them more credibility. If my factors are closer to optimum, then you will improve that situation. At least you will charge your poorer groups more, and you will not lose them.

MR. KOLOMS: I'm assuming we're still going to lapse those same groups that we would of lapsed otherwise. To say we're going to charge higher rates on groups that we're not going to renew doesn't do us any good.

MR. FUHRER: I understand that in the marketplace where everybody doesn't use enough credibility that there may be some sort of strange positions that can occur. In fact, I dealt with that a little bit in one section of my paper.

Here I dealt with the situation where you're not giving out the experience on your own groups so that other insurers essentially are at their manual, then there doesn't seem to be much point in giving much credibility at all for the good experience, because essentially you can overcharge those groups and still not lose them. So it might be worthwhile in that case to use less credibility for good groups. Even though most group actuaries do not believe that credibility should be as high as I suggest, I believe that the situation is changing. Furthermore, I think that by the time the salesmen and the underwriters get done rating groups, I think a lot more credibility is essentially used than the actuary knows. Your scenario assumes that the whole marketplace is using credibility as low as and lower than yours. I also do not believe, given your low credibilty, that you are always not renewing the groups that have bad experience. One more comment, when you're rating small groups, I think it's really important to look at the claim history and, if you know you more than the total claims, to use this knowledge. For example, if individuals in the group that had high claims have now died or completely recovered, it wouldn't make sense to give their claims as much credibility as ones that could continue. Also, under the extension of benefit provisions that you have, presumably, you wouldn't be able to get off a claim where the individual was disabled even if the group canceled. If the person who had a continuing claim was actively at work, you might want to give that group even a higher rate increase just to make sure the next carrier got the claim. Thus the disabled claimant's claims might be more credible! That's kind of a practical strategy that I don't know how many companies are following, but it seems like if you're trying to maximize your bottom line it's one thing to think about.

MR. KOLOMS: Now, what's going to happen out in the real world, what is your opinion if all the companies started to adopt this? What would happen is, I think, we'd get a very bad reaction from the brokers. With your factors, every time they write a group that ends up with a large claim, that group is suddenly given a very large rate increase, and then when that person disappears, there is going to be a small rate increase. I think the brokers will be completely against that sort of roller coasting up and down, and they would prefer the low credibility with more stable rates.

MR. FUHRER: That's possible, although some of the drift I've heard from salespeople and brokers, at least when you get into the medium market, is that they'd like to see higher credibility. I think that the sale becomes easier. The brokers tell the group that they trended the group's claims and that's what the brokers are charging the group. If the brokers tell the groups that this rates are based on the brokers' manual rates, then the group says, "We don't know where your manual came from, we don't know if it's right for us." So sometimes it becomes easier for your sales departments to sell with higher credibility. Many salespeople are pushing companies to raise their credibility factors. So I'm not sure if the force of opinion goes in the direction you say it does. Now, at the very smallest groups it might. Also for the five- or ten-life group, I recommended, in my paper, pooling points that were low, such as $5,000. So there may not be such large fluctuations that result from the large claim on one individual.

MR. GOLENDA: Intuitively, I'm inclined to think that a group having experience that's a whole lot better than average or a whole lot worse than average is more credible than a group that has close to average experience. Did you look at anything like that, and what are your thoughts on that subject?

MR. FUHRER: No, and it's worth pointing out that what you've described doesn't always seem so intuitive. It means that the further away you are from what you expect, the more you believe it.

MR. GOLENDA: The less likely it would happen by dumb luck.

MR. FUHRER: I suppose that's true. I've actually seen some credibility models that did that sort of thing. Another thing I did in the paper was I tried a quadratic formula which did the exact opposite of what you said. This probably is an area for some further research which I may do. I think you could construct models that do what you said. In fact, I have seen a paper with such models in *1986.1 ARCH*, "Observation -- Dependent Credibility Weights," pp. 55-78 by William S. Jewell and Rene Schnieper. I don't want to debate which model is more intuitive. I mean I'm not sure what the right answer to that would be, but if we had enough data we could determine which model fits better. I think that might be an interesting study.

SEMINAR FORMAT

APPENDIX

A Practical Look at Group Medical Credibility
Charles S. Fuhrer

On our examination syllabus the only material that deals with the amount of credibility to give to a group's own experience for rating its medical insurance is "On the Credibility of Group Insurance Claim Experience" by M. H. Margolin, *TSA* XXIII, 1971. In this paper a relatively straightforward and good formula for the credibility is derived. The credibility is set equal to the linear regression coefficient (of one year regressed on the previous year) calculated for a set of groups. This coefficient is equal to the covariance between two years of experienced group loss ratios divided by the first year variance.

Because this formula is calculated at the group level, the credibility for a particular size of group is based on groups of the same or nearly the same size only. This creates the difficulty that very few group insurance companies would have data on enough groups to get an answer for all of a set of reasonably narrow size brackets. A company would need enough groups for each size bracket. Quite a bit of data is needed because the standard method of estimating the coefficient is very sensitive to outliers. For example, one group with very good experience in one of the years and very bad in the other could greatly reduce the estimate of even make it negative. It requires a huge sample to get reliable estimates.

In order to solve this problem, some actuaries have looked to some other statistical models that use the individual employee data in the credibility estimate. One such popular model gives the formula:

$$\text{Credibility} = m/(m+k),$$

where m is the number of individuals in a group and k is a constant that can be estimated from data.

This model turns out to work quite well for life or accidental death insurance. For group medical insurance, however, it is not so appropriate. The model on which this formula is based assumes that, in estimating one particular individual's claims of next year, as much information is available from the claims of each of the other individuals in the group as from the claims of that one individual. In other words, the correlation between an individual's claims in two successive years is the same as the correlation between the claims of one individual in the first year and a second individual's claims in the second year.

I believe that this is not a good assumption for group medical insurance. In group medical, claims in the first year give much more information about claims in the second year for that individual than for the other individuals in the group. For example, if someone has surgery in one year, he is much more likely to have similar surgery in the second year. High bills for chronic conditions often continue for several years. Companies that write individual health insurance policies essentially recognize this concept by basing premium rates on the health status of the individual.

An appropriate credibility factor for one-life groups would be the linear regression coefficient previously mentioned, estimated from individual claims covariance and variance. I calculated this as approximately 25% from actual health insurance data from Blue Cross and Blue Shield of Illinois. I have spoken to a few other actuaries and they also estimate 20% to 30%. This order of magnitude seems reasonable and intuitive. However, if we use the formula $m/(m+k)$ and the generally accepted assumption that a 50 life group is no more than 50% credible, then $k \geq 50$, and a one-life group will have a credibility of less than 2%. How can we reconcile these two approaches?

William F. Bluhm in his study note (number 422-29-89) "Experience Rating and Funding Methods" recognizes this problem. On page 2 he writes:

> In developing theoretical models of group claims, one commonly made assumption is the stochastic independence of claims. This means that the existence and size of a claim in a given period (such as an upcoming policy year) is independent of the claims which occurred in a prior period. This may be more or less true for some coverages, such as nonoccupational accidental death. It is definitely untrue with others, such as medical expense coverages. For this reason, many of the theoretical models used today to develop credibility levels may understate the relevance of past experience. This fact may somewhat justify the competitively-based experience rating formulas which are commonly in use today.
>
> Although the commonly made assumption is actually that the correlation of claims from one period to the next on an individual is very low, the author is also referring to the same problem mentioned above: that the formula $m/(m+k)$ understates the credibility for smaller groups.

The solution is to use the formula: Credibility = $\dfrac{k_1 + (m-1)k_2}{1 + (m-1)k_2}$.

The first constant, k_1, is the linear regression coefficient for individuals (about 25%). The second constant, k_2, is somewhat more difficult to estimate but is probably 1% to 2%.

Here is one method to estimate the constants k_1 and k_2. First, obtain adequate claim data for groups that are insured continuously for two consecutive years. The data should be organized by year, individual, and group. Individuals who had no claims should be included as zero claim amounts. Divide each individual's claim amount by the correct tabular premium for that individual to get loss ratios. Be sure to use an age-sex adjusted premium for each individual. Determine the overall mean of the loss ratios for each year. Subtract the mean by year from each individual's loss ratio to get residual deviation from the mean (RDM) for each individual for each year. Estimate k_1 as: the sum (in all of the groups) of each individual's two year product of RDMs, divided by the sum over all individuals of the square of their first year RDMs.

Estimation of k_2 is somewhat more complicated. This method uses only the first year RDMs. Let R be the sum of the squares of each group's sum of RDMs divided by the

sum (over all groups) of the squares of each individual's RDM. Let N be the sum of the squares of the number of individuals in each group divided by the total individuals in all groups. Estimate k_2 = (R-1)/(N-1). Unfortunately, this estimate also can be very sensitive to one unusual group. If this method gives a ridiculous value, it would be better to set it arbitrarily from 0.5% to 2.5%, rather than to abandon this method.

For the derivation of the credibility formula and some other applications see my paper "Some Applications of Credibility Theory to Group Insurance" *TSA* XL, 1988.