

**THE INDIVIDUAL ACCIDENT AND HEALTH  
LOSS RATIO DILEMMA**

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**ABSTRACT**

The principal objective of this paper is to remind actuaries of the rather significant misconceptions and distortions commonly encountered in the use of individual accident and health insurance loss ratios. These ratios are used routinely in periodic filings with regulatory authorities, communications within the health insurance industry, and discussions among insurance company management groups. Much of the distortion is traceable to the actuarial approach used to reflect active life additional reserve changes in the loss ratios for level premium business. A typical pattern of incurred loss ratios is projected over a reasonable lifetime of a block of level premium individual health insurance policies. These ratios then are modified by (1) changing the active life additional reserve method, (2) adjusting the interest rate assumption inherent in the additional reserves, and (3) using realistic assumptions as to interest, mortality, withdrawal, morbidity, and underwriting selection in the reserve calculations.

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**INTRODUCTION**

**C**ONSIDERABLE uncertainty often exists among health insurance actuaries concerning the definition and development of meaningful and generally acceptable individual accident and health loss ratios. Such loss ratios are useful in analyzing claim experience for financial reporting and management purposes and in discussions between actuaries and nonactuaries concerning pricing. Loss ratios (or the figures used to develop them) are presented in the statutory Annual Statement in several places. However, the term "loss ratio" is not defined uniquely, and therefore considerable confusion often exists. Current practices result in inconsistencies in the presentation of data, lack of uniformity in the use of data, and lack of effective communication between actuaries and nonactuaries.

Loss ratios may be derived from premium, benefit, and reserve (or liability) data presented in the statutory Annual Statement. Premiums, benefits, and reserve changes are shown separately in the Gain from

Operations section of the Annual Statement. Changes in gross unearned premiums may be used to affect reported premium revenue or may be considered part of an active life reserve change. Changes in claim reserves are treated as reserve changes rather than adjustments to incurred benefits. Active life additional reserve changes are shown separately from premiums and benefits.

In Schedule H and in the Accident and Health Policy Experience Exhibit, changes in claim reserves are treated as benefits. Active life additional reserve changes may be considered modifications either to premium revenue or to benefit costs. Casualty actuaries traditionally treat active life additional reserve changes as modifications to premium revenue whereas life actuaries usually consider them to be benefit costs. Furthermore, casualty actuaries typically include in health insurance liabilities the expenses of settling losses (as loss adjustment expense reserves) while life actuaries usually do not.

Loss ratios commonly developed by life companies might involve the following: (1) ratios of paid claims to collected premiums, (2) ratios of incurred claims to some type of earned premiums, (3) ratios where changes in active life additional reserves are reflected as adjustments to premiums *or* as modifications to benefit costs, and (4) ratios that typically have not been adjusted for important considerations such as investment income and/or the expenses of settling claims.

Study materials prepared by the Society of Actuaries indicate the importance of health insurance loss ratios because of their availability, acceptability, and supposed understandableness. Presently, NAIC committees are apparently giving preliminary attention to model procedures for submitting health insurance data in the form of loss ratios as documentation for gross premiums and for premium increases on existing policies. However, considerable caution should be used in interpreting health insurance loss ratios, and the Society of Actuaries' textbook *Health Insurance Provided through Individual Policies* cautions the reader in this regard.

#### PURPOSES OF PAPER

One purpose of this paper is to illustrate a typical pattern of incurred loss ratios over time for a closed block of level premium health insurance policies. Another intent is to review the effects on incurred loss ratios of changes in statutory active life additional reserves. Since the principal purpose of statutory additional reserves is to provide a conservative test of the solvency of the health insurance underwriter, do such reserve changes provide meaningful figures for analyzing loss ratios, or are loss ratios distorted by too much supposed conservatism?

Changes in realistic active life additional reserves are also developed in this paper. Since these reserves reflect investment income assumptions, it is necessary to make adjustments for investment income in analyzing claim experience through loss ratios. Since such calculations are developed routinely by many life and health insurance companies for generally accepted accounting principles (GAAP) reporting purposes, is it feasible or desirable to introduce similar realistic reserves into the statutory reporting system?

From the analyses in this paper, certain preliminary suggestions evolve as to feasible definitions of loss ratios that might be used by company management for analyzing health insurance results by plan and that could be considered by the NAIC as supportive documentation for health insurance gross premium rate filings with state insurance departments.

Furthermore, as is demonstrated in the body of this paper, distortions of loss ratios are caused by reserve changes if the actuary does not adjust at least for the following:

1. Use of the preliminary term reserve method as compared with the net level premium reserve method.
2. Effects of assumed investment income on health insurance reserves.
3. Lack of use of withdrawal rates in traditional statutory active life additional reserve calculations.
4. Differences between statutory morbidity tables and actual health insurance claim costs (including the effects of any underwriting selection).

#### A DEVELOPING PATTERN OF INCURRED LOSS RATIOS

A typical pattern, or slope, of incurred loss ratios is shown in column 5 of Table 1 for an individual accident and health plan with a level premium to age 65, issued to a male aged 40, and providing daily hospital (room and board) type benefits. It is believed that the slope of incurred loss ratios would be similar for level premium disability income insurance.

The Table 1 projections are based on the issue of 10,000 policies and are representative of a closed block of business. Premium revenue declines each year because of the lack of persistency and because of deaths, but the loss ratios rise each year because of the aging of the insured group. The slope of the loss ratios reflects the effects of underwriting selection during the early years. No inflation in claim costs or increases in gross premiums are contemplated in these illustrative projections. It is only just prior to attained age 60 that claim costs first exceed premium revenue.

The actuarial assumptions underlying the projections shown in Table 1 include the following:

1. The group consists of male insureds, issue age 40, with daily hospital benefit coverage to age 65. Benefits are \$10 per day, with a 90-day maximum benefit period.
2. Withdrawal (lapse) rates are 30 percent in the first year, 20 percent in the second year, 15 percent in the third year, 10 percent in the fourth year, and 5 percent per annum thereafter.
3. The mortality rates are based on the 1965-70 Ultimate Basic Mortality Table for males on an age-nearest-birthday basis.
4. The gross annual premium is \$15 per policy, payable at the beginning of the year.

TABLE 1  
PROJECTED PREMIUMS, CLAIMS, AND LOSS RATIOS

Policy Year	Attained Age	Number of Policies at Beginning of Year	Gross Premium Revenue	Incurred Claims	Incurred Claims Loss Ratio
	(1)	(2)	(3)	(4)	(5)
1.....	40	10,000.0	\$150,000	\$43,379	28.9%
2.....	41	6,978.0	104,670	38,257	36.6
3.....	42	5,565.4	83,481	34,853	41.7
4.....	43	4,715.7	70,736	33,592	47.5
5.....	44	4,230.2	63,453	34,052	53.7
6.....	45	4,004.8	60,072	33,713	56.1
7.....	46	3,790.1	56,852	33,301	58.6
8.....	47	3,585.5	53,783	32,856	61.1
9.....	48	3,390.4	50,856	32,412	63.7
10.....	49	3,204.2	48,063	31,900	66.4
11.....	50	3,026.3	45,395	31,384	69.1
12.....	51	2,856.3	42,845	30,887	72.1
13.....	52	2,694.0	40,410	30,404	75.2
14.....	53	2,539.0	38,085	29,926	78.6
15.....	54	2,391.2	35,868	29,472	82.2
16.....	55	2,250.0	33,750	29,092	86.2
17.....	56	2,114.9	31,724	28,704	90.5
18.....	57	1,985.6	29,784	28,354	95.2
19.....	58	1,861.6	27,924	28,080	100.6
20.....	59	1,743.0	26,145	27,823	106.4
21.....	60	1,629.5	24,443	27,569	112.8
22.....	61	1,521.2	22,818	27,317	119.7
23.....	62	1,417.7	21,266	27,010	127.0
24.....	63	1,318.9	19,784	26,679	134.9
25.....	64	1,224.4*	18,366	26,285	143.1

\* Number of policies at end of policy year 25 is 1,134.1.

5. Expected morbidity is based on the 1974 Hospital Table published by Nelson and Warren, Inc. Claims are incurred as a function of the average of the number of policies in force at the beginning and end of each year. The underwriting selection factors, as percentages of the male 1974 Hospital Table claim costs, are 70 percent in the first year, 80 percent in the second year, 85 percent in the third year, 90 percent in the fourth year, and 95 percent thereafter.

EFFECTS OF CHANGES IN STATUTORY ACTIVE LIFE ADDITIONAL RESERVES  
ON INCURRED LOSS RATIOS

Statutory active life additional reserves and the changes in these reserves are shown in Table 2, using both the net level premium reserve method and the two-year preliminary term reserve method. The reserves

TABLE 2  
STATUTORY ACTIVE LIFE ADDITIONAL RESERVES

YEAR	RESERVES AT END OF YEAR		CHANGES IN RESERVES DURING YEAR	
	Net Level Premium Method (1)	Two-Year Preliminary Term Method (2)	Net Level Premium Method (3)	Two-Year Preliminary Term Method (4)
1.....	\$ 33,494	\$ 0	\$ 33,494	\$ 0
2.....	52,426	0	18,932	0
3.....	65,360	22,352	12,934	22,352
4.....	76,482	39,172	11,122	16,820
5.....	88,506	54,465	12,024	15,293
6.....	97,936	66,933	9,430	12,468
7.....	105,270	77,088	7,334	10,155
8.....	110,391	84,896	5,121	7,808
9.....	113,813	90,807	3,422	5,911
10.....	115,363	94,723	1,550	3,916
11.....	115,566	97,057	203	2,334
12.....	114,118	97,738	- 1,448	681
13.....	111,513	96,990	- 2,605	- 748
14.....	107,556	94,835	- 3,957	- 2,155
15.....	102,555	91,440	- 5,001	- 3,395
16.....	96,313	86,795	- 6,242	- 4,645
17.....	89,114	81,012	- 7,199	- 5,783
18.....	80,868	74,054	- 8,246	- 6,958
19.....	71,672	66,129	- 9,196	- 7,925
20.....	61,530	57,065	-10,142	- 9,064
21.....	50,565	47,218	-10,965	- 9,847
22.....	38,788	36,350	-11,777	-10,868
23.....	26,404	24,874	-12,384	-11,476
24.....	13,419	12,685	-12,985	-12,189
25.....	0	0	-13,419	-12,685

are based on the male 1974 Hospital Table, 1958 CSO mortality, and 3 percent interest. The same withdrawal and mortality assumptions were used as in developing the Table 1 projections. The reserves equal the terminal factors multiplied by the number of policies in force at the end of each year.

When the reserve changes in columns 3 and 4 of Table 2 are expressed as percentages of gross premium revenue and are used to modify the claim cost ratios from column 5 of Table 1, the loss ratios that result (Table 3) have a considerably more level slope than the original loss ratios. Note the differences in the pattern of additional reserve changes between the net level method and the two-year preliminary term method and the corresponding effects on the loss ratios.

The pattern of the combined loss ratios (incurred claims plus additional reserve changes) differs considerably depending upon whether the net level premium or the preliminary term method is used. The combined net level reserve loss ratio starts at over 50 percent, climbs rather quickly to over 70 percent, and does not dip much below 70 percent thereafter. The preliminary term reserve combined loss ratio is the same as the incurred claims loss ratio in the first two years, of course, and then increases rapidly to a plateau just over 75 percent before gradually dropping back to the 70-75 percent range.

If the persistency and morbidity assumptions are exactly the same for both the experience projections of Table 1 and the additional reserve calculations, the incurred claims loss ratios, when combined with reserve changes and expressed as percentages of premium revenue, theoretically should equal the ratios of the net reserve premiums to the gross premiums, provided that appropriate actuarial adjustments are made for the investment income assumptions used in calculating the reserve factors. The actuarial theory for these relationships is outlined in Appendix I. Adjustments to loss ratios to reflect investment income assumptions are denoted in Tables 4 and 5 as level premium adjustments for interest. Table 4 shows results for the net level premium reserve method and Table 5 for the two-year preliminary term reserve method. A statutory interest rate of 3 percent per annum is assumed.

As one might expect, these level premium reserve interest adjustments do not produce constant patterns of loss ratios because of differences between reserve assumptions and actual experience with regard to morbidity, underwriting selection, withdrawal, and mortality. There is a tendency for the slope of the loss ratios to be more level, however, if the ratios are adjusted for investment income. The theoretical ratios of the net premium to the gross premium are 78.8 percent ( $\$11.82/\$15.00$ ) for

net level premium reserves and 82.8 percent (\$12.42/\$15.00) for two-year preliminary term reserves.

Comparisons of the interest-adjusted ratios from column 4 of Tables 4 and 5 with the loss ratios in columns 4 and 5 of Table 3 suggest that the impact of the interest rate assumption underlying the additional reserve calculations should not be ignored completely.

TABLE 3  
INCURRED CLAIMS AND ACTIVE LIFE ADDITIONAL RESERVE CHANGES AS  
PERCENTAGES OF PREMIUM REVENUE

YEAR	INCURRED CLAIMS LOSS RATIO  (1)	CHANGES IN ADDITIONAL RESERVES AS PERCENTAGE OF PREMIUM REVENUE		INCURRED CLAIMS LOSS RATIOS PLUS ADDITIONAL RESERVE CHANGES	
		Net Level Premium Method (2)	Two-Year Preliminary Term Method (3)	Net Level Premium Method (4)	Two-Year Preliminary Term Method (5)
1.....	28.9%	22.3%	0.0%	51.2%	28.9%
2.....	36.6	18.1	0.0	54.7	36.6
3.....	41.7	15.5	26.8	57.2	68.5
4.....	47.5	15.7	23.8	63.2	71.3
5.....	53.7	18.9	24.1	72.6	77.8
6.....	56.1	15.7	20.8	71.8	76.9
7.....	58.6	12.9	17.9	71.5	76.5
8.....	61.1	9.5	14.5	70.6	75.6
9.....	63.7	6.7	11.6	70.4	75.3
10.....	66.4	3.2	8.1	69.6	74.5
11.....	69.1	0.4	5.1	69.5	74.2
12.....	72.1	- 3.4	1.6	68.7	73.7
13.....	75.2	- 6.4	- 1.9	68.8	73.3
14.....	78.6	-10.4	- 5.7	68.2	72.9
15.....	82.2	-13.9	- 9.5	68.3	72.7
16.....	86.2	-18.5	-13.8	67.7	72.4
17.....	90.5	-22.7	-18.2	67.8	72.3
18.....	95.2	-27.7	-23.4	67.5	71.8
19.....	100.6	-32.9	-28.4	67.7	72.2
20.....	106.4	-38.8	-34.7	67.6	71.7
21.....	112.8	-44.9	-40.3	67.9	72.5
22.....	119.7	-51.6	-47.6	68.1	72.1
23.....	127.0	-58.2	-54.0	68.8	73.0
24.....	134.9	-65.6	-61.6	69.3	73.3
25.....	143.1	-73.1	-69.1	70.0	74.0

Col. 1 is the same as col. 5 of Table 1.

Col. 2 is based on the ratios of col. 3 of Table 2 to col. 3 of Table 1.

Col. 3 is based on the ratios of col. 4 of Table 2 to col. 3 of Table 1.

Col. 4 equals col. 1 plus col. 2.

Col. 5 equals col. 1 plus col. 3.

## REALISTIC ADDITIONAL RESERVE CHANGES AND LOSS RATIOS

Realistic additional reserves and associated reserve changes are shown in Table 6. These reserves involve the same actuarial assumptions as outlined for the Table 1 projections plus a 6 percent per annum interest rate assumption. They are analogous to GAAP reserves except that no margin for adverse deviation is included. Included in Table 6 for com-

TABLE 4  
INVESTMENT INCOME MODIFICATIONS TO LOSS RATIOS

YEAR	STATUTORY NET LEVEL PREMIUM RESERVE METHOD			
	Partial Level Premium Adjustment for Interest (1)	Col. 1 as Percentage of Premium (2)	Statutory Loss Ratio plus Reserve Change (3)	(3)/1.03+(2) (4)
1.....	632	0.4%	51.2%	50.1%
2.....	- 418	-0.4	54.7	52.7
3.....	-1,019	-1.2	57.2	54.3
4.....	-1,414	-2.0	63.2	59.4
5.....	-1,732	-2.7	72.6	67.8
6.....	-2,087	-3.5	71.8	66.2
7.....	-2,368	-4.2	71.5	65.2
8.....	-2,588	-4.8	70.6	63.7
9.....	-2,743	-5.4	70.4	62.9
10.....	-2,850	-5.9	69.6	61.7
11.....	-2,903	-6.4	69.5	61.1
12.....	-2,916	-6.8	68.7	59.9
13.....	-2,881	-7.1	68.8	59.7
14.....	-2,812	-7.4	68.2	58.8
15.....	-2,703	-7.5	68.3	58.8
16.....	-2,563	-7.6	67.7	58.1
17.....	-2,387	-7.5	67.8	58.3
18.....	-2,183	-7.3	67.5	58.2
19.....	-1,946	-7.0	67.7	58.7
20.....	-1,682	-6.4	67.6	59.2
21.....	-1,391	-5.7	67.9	60.2
22.....	-1,075	-4.7	68.1	61.4
23.....	- 736	-3.5	68.8	63.3
24.....	- 381	-1.9	69.3	65.4
25.....	- 8	0	70.0	68.0

Col. 1 equals  $-(0.03/1.03) \times$  (col. 1 of Table 2 set back one year, less 50 percent of col. 4 of Table 1), or, using the actuarial notation from Appendix I,  $-(0.03/1.03)[{}_{t-1}V_x - \frac{1}{2}S_x(1 - q_x/2)]$ .

Col. 2 is col. 1 as a percentage of the premium revenue from col. 3 of Table 1.

Col. 3 is the same as col. 4 of Table 3.



parative purposes are the loss ratios obtained by using statutory additional reserve changes. The slopes of the loss ratios differ significantly by reserve approach, a fact that should be of concern to anyone attempting an analysis of accident and health experience through the use of loss ratios. (The formula and underlying actuarial assumptions for the calculation of realistic reserve factors are shown in Appendix II.)

TABLE 5  
INVESTMENT INCOME MODIFICATIONS TO LOSS RATIOS

YEAR	STATUTORY TWO-YEAR PRELIMINARY TERM RESERVE METHOD			
	Partial Level Premium Adjustment for Interest (1)	Col. 1 as Percentage of Premium (2)	Statutory Loss Ratio plus Reserve Change (3)	(3)/1.03+(2) (4)
1.....	632	0.4%	28.9%	28.5%
2.....	557	0.5	36.6	36.0
3.....	508	0.6	68.5	67.1
4.....	— 162	-0.2	71.3	69.0
5.....	— 645	-1.0	77.8	74.5
6.....	-1,095	-1.8	76.9	72.9
7.....	-1,465	-2.6	76.5	71.7
8.....	-1,767	-3.3	75.6	70.1
9.....	-2,001	-3.9	75.3	69.2
10.....	-2,180	-4.5	74.5	67.8
11.....	-2,302	-5.1	74.2	66.9
12.....	-2,377	-5.5	73.7	66.1
13.....	-2,404	-5.9	73.3	65.3
14.....	-2,389	-6.3	72.9	64.5
15.....	-2,333	-6.5	72.7	64.1
16.....	-2,240	-6.6	72.4	63.7
17.....	-2,110	-6.7	72.3	63.5
18.....	-1,947	-6.5	71.8	63.2
19.....	-1,748	-6.3	72.2	63.8
20.....	-1,521	-5.8	71.7	63.8
21.....	-1,261	-5.2	72.5	65.2
22.....	— 977	-4.3	72.1	65.7
23.....	— 665	-3.1	73.0	67.8
24.....	— 336	-1.7	73.3	69.5
25.....	13	0.1	74.0	71.9

Col. 1 is calculated in the same way as col. 1 of Table 4, except that the reserve figures from col. 2 of Table 2 instead of from col. 1 of Table 2 are used.

Col. 2 is col. 1 as a percentage of the premium revenue from col. 3 of Table 1.

Col. 3 is the same as col. 5 of Table 3.

Loss ratios based on realistic additional reserve changes tend to be more level than the statutory ratios. They are higher during the early years than those based on statutory reserve changes, fall below the statutory ratios after the initial years, and then, except for the policy years just prior to attained age 65, are at a level between those based on net level premium reserves and those based on two-year preliminary term reserves.

Interest adjustments to realistic loss ratios are shown in Table 7. These adjustments are based on the same type of reserve change theory as outlined in Appendix I. The resulting interest-adjusted loss ratios (col. 4)

TABLE 6  
COMPARISONS OF LOSS RATIOS THAT INCLUDE RESERVE CHANGES

YEAR	REALISTIC (GAAP TYPE) RESERVES	REALISTIC RESERVE CHANGE	LOSS RATIO PLUS REALISTIC RESERVE CHANGE	LOSS RATIO PLUS STATUTORY RESERVE CHANGE	
				Net Level Premium Method (4)	Two-Year Preliminary Term Method (5)
	(1)	(2)	(3)	(4)	(5)
1. ....	\$ 40,542	\$40,542	55.9%	51.2%	28.9%
2. ....	63,000	22,458	58.1	54.7	36.6
3. ....	78,328	15,328	60.1	57.2	68.5
4. ....	88,580	10,252	62.0	63.2	71.3
5. ....	94,834	6,254	63.6	72.6	77.8
6. ....	99,945	5,111	64.6	71.8	76.9
7. ....	103,908	3,963	65.6	71.5	76.5
8. ....	106,865	2,957	66.6	70.6	75.6
9. ....	108,783	1,918	67.5	70.4	75.3
10. ....	109,734	951	68.4	69.6	74.5
11. ....	109,768	34	69.2	69.5	74.2
12. ....	108,891	- 877	70.1	68.7	73.7
13. ....	107,044	- 1,847	70.6	68.8	73.3
14. ....	104,304	- 2,740	71.4	68.2	72.9
15. ....	100,575	- 3,729	71.8	68.3	72.7
16. ....	95,805	- 4,770	72.1	67.7	72.4
17. ....	90,007	- 5,798	72.2	67.8	72.3
18. ....	83,120	- 6,887	72.1	67.5	71.8
19. ....	75,036	- 8,084	71.6	67.7	72.2
20. ....	65,718	- 9,318	70.8	67.6	71.7
21. ....	55,144	- 10,574	69.5	67.9	72.5
22. ....	43,268	- 11,876	67.7	68.1	72.1
23. ....	30,124	- 13,144	65.2	68.8	73.0
24. ....	15,685	- 14,439	61.9	69.3	73.3
25. ....	0	- 15,685	57.7	70.0	74.0

Cols. 4 and 5 are from cols. 4 and 5, respectively, of Table 3.

are the same in all years, since the experience and reserve assumptions are identical as to persistency, mortality, underwriting selection, morbidity, timing of premium collections, claim cost incurrals, and interest. The ratios after adjustment for interest are, in essence, 53.6 percent, which is the ratio of the realistic additional reserve premium to the gross premium (\$8.03635/\$15.00).

## ANALYZING INDIVIDUAL ACCIDENT AND HEALTH LOSS RATIOS

For convenience of reference and further analysis, the various loss ratios developed in this paper are summarized in Table 8. The ratios have

TABLE 7  
REALISTIC NET LEVEL ADDITIONAL RESERVES

Year	Partial Level Premium Adjustment for Interest (1)	Column (1) as Percentage of Premium (2)	Realistic Loss Ratio plus Reserve Change (3)	(3)/1.06+(2) (4)
1.....	1,228	0.8%	55.9%	53.5%
2.....	-1,212	- 1.2	58.1	53.6
3.....	-2,580	- 3.1	60.1	53.6
4.....	-3,483	- 4.9	62.0	53.6
5.....	-4,050	- 6.4	63.6	53.6
6.....	-4,414	- 7.3	64.6	53.6
7.....	-4,715	- 8.3	65.6	53.6
8.....	-4,952	- 9.2	66.6	53.6
9.....	-5,132	-10.1	67.5	53.6
10.....	-5,255	-10.9	68.4	53.6
11.....	-5,323	-11.7	69.2	53.6
12.....	-5,339	-12.5	70.1	53.6
13.....	-5,303	-13.1	70.6	53.5
14.....	-5,212	-13.7	71.4	53.7
15.....	-5,070	-14.1	71.8	53.6
16.....	-4,870	-14.4	72.1	53.6
17.....	-4,611	-14.5	72.2	53.6
18.....	-4,292	-14.4	72.1	53.6
19.....	-3,910	-14.0	71.6	53.5
20.....	-3,460	-13.2	70.8	53.6
21.....	-2,940	-12.0	69.5	53.6
22.....	-2,348	-10.3	67.7	53.6
23.....	-1,685	- 7.9	65.2	53.6
24.....	- 950	- 4.8	61.9	53.6
25.....	- 144	- 0.8	57.7	53.6

Col. 1 equals  $-(0.06/1.06) \times$  (beginning reserve from col. 1 of Table 6 less 50 percent of the incurred claims for the year from col. 4 of Table 1).  
Col. 2 is col. 1 as a percentage of the premium revenue from col. 3 of Table 1.

Col. 3 is the same as col. 3 of Table 6.

been rounded to the nearest percent, and, after the first five years, only the odd-year loss ratios are shown, in order to highlight the developing patterns.

The ideal approach for analyzing individual accident and health loss-ratio experience for management purposes, early warning as to claim cost problems, and justification and documentation as needed for premium rate filings is to develop active life additional reserves based on actuarial assumptions that prove to be almost the same as actual experience with respect to morbidity, persistency, mortality, underwriting effects on claim patterns, and investment income. Acceptable results likely would be obtained if the reserves at least involve realistic assumptions as to morbidity, withdrawal, underwriting selection, and investment income.

TABLE 8  
SUMMARY OF LOSS RATIOS

YEAR	INCURRED CLAIMS LOSS RATIO	INCURRED CLAIMS LOSS RATIO PLUS RESERVE CHANGES*					
		Statutory Reserves without Interest		Statutory Reserves with Interest		Reserves Based on Realistic Assumptions	
		Two-Year Preliminary Term	Net Level	Two-Year Preliminary Term	Net Level	Without Interest	With Interest
		(1)	(2)	(3)	(4)	(5)	(6)
1.....	29%	29%	51%	29%	50%	56%	54%
2.....	37	37	55	36	53	58	54
3.....	42	69	57	67	54	60	54
4.....	48	71	63	69	59	62	54
5.....	54	78	73	75	68	64	54
7.....	59	77	72	72	65	66	54
9.....	64	75	70	69	63	68	54
11.....	69	74	70	67	61	69	54
13.....	75	73	69	65	60	71	54
15.....	82	73	68	64	59	72	54
17.....	91	72	68	64	58	72	54
19.....	101	72	68	64	59	72	54
21.....	113	73	68	65	60	70	54
23.....	127	73	69	65	63	65	54
25.....	143	74	70	72	68	58	54
Prior Column and Table Reference							
Table . . .	1	3	3	5	4	6	7
Column .	4	5	4	4	4	3	4

\* Expressed as percentages of premium revenue.

Estimates of the true loss ratios (those based on changes in active life additional reserves with an interest adjustment) are distorted the most by the use of a preliminary term reserve method without an interest adjustment. The loss ratios developed from net level additional reserves without interest, are significantly better but still rather high, especially in the later years. The use of statutory net level reserves with appropriate investment income adjustments results in fair approximations to the true loss ratios during the early policy years but a definite tendency to overstate loss experience as a block of business matures.

#### SPECIFICATIONS FOR MEANINGFUL ACCIDENT AND HEALTH LOSS RATIOS

It is perceived that there is a great need for uniform specifications for the development of individual accident and health loss ratios.

The calculation of loss ratios involves first the necessary accruals to claims and premiums to develop incurred claims and earned gross premiums and then the appropriate reflection of active life additional reserve changes.

Incurred claims involve claim payments and accruals to reflect the changes in liabilities from Exhibit 11 and the changes in claim reserves from Exhibit 9, Part B, of the statutory Annual Statement. Earned gross premiums are developed from collected premiums and involve accruals for advance and due premiums from Exhibit 1 and changes in gross unearned premium reserves from Exhibit 9, Part A.

Ideally, changes in active life additional reserves should reflect realistic assumptions with respect to morbidity and associated underwriting selection effects, persistency, mortality, and investment earnings. The actuarial mechanics for adjusting for investment income have been outlined in this paper. Since many companies report to stockholders routinely on the basis of generally accepted accounting principles, the development of realistic reserve changes is not perceived to be an unusual, expensive, or unduly complicated undertaking. As an alternative, the use of statutory net level additional reserve changes based on morbidity assumptions reasonably close to actual experience, adjusted for the interest rate assumption, would serve to produce reasonable approximations to the true underlying loss ratios, which, it is hoped, would remain relatively constant for each year of experience for a homogeneous block of business.

## APPENDIX I

INTEREST ADJUSTMENTS TO STATUTORY  
RESERVE LOSS RATIOS

$$({}_{t-1}V_x + P_x)(1 + i) - (S_x) \left(1 - \frac{q_x}{2}\right) \left(1 + \frac{i}{2}\right) = (1 - q_x)({}_tV_x), \quad (1)$$

where, for statutory reserves,  ${}_{t-1}V_x$ ,  $P_x$ ,  $S_x$ , and  ${}_tV_x$  are based on the male 1974 Hospital Table, 3 percent interest, and the 1958 CSO Mortality Table.

$$P_x(1 + i) = (1 - q_x)({}_tV_x) - {}_{t-1}V_x + (S_x) \left(1 - \frac{q_x}{2}\right) - i \left[ {}_{t-1}V_x - \frac{1}{2}(S_x) \left(1 - \frac{q_x}{2}\right) \right]. \quad (2)$$

$$P_x = \frac{(1 - q_x)({}_tV_x) - {}_{t-1}V_x + (S_x)(1 - q_x/2)}{1 + i} - \left( \frac{i}{1 + i} \right) \left[ {}_{t-1}V_x - \frac{1}{2}(S_x) \left(1 - \frac{q_x}{2}\right) \right]. \quad (3)$$

$$P_x = \frac{\text{Active life additional reserve change plus incurred claims}}{1 + i} - \left( \frac{i}{1 + i} \right) (\text{Beginning reserve, minus } 50\% \text{ of incurred claims}), \quad (4)$$

where

$$\text{Reserve change} = (1 - q_x)({}_tV_x) - {}_{t-1}V_x;$$

$$\text{Incurred claims} = (S_x)(1 - q_x/2);$$

$$\text{Beginning reserve} = {}_{t-1}V_x; \quad \text{and}$$

$$50\% \text{ of incurred claims} = \frac{1}{2}(S_x)(1 - q_x/2).$$

If withdrawal assumptions are introduced into the active life additional reserve equation (eq. [1] above), the description of formula (4) would be unchanged.

## APPENDIX II

REALISTIC RESERVE FACTOR FORMULA AND  
UNDERLYING ACTUARIAL ASSUMPTIONS

$$({}_{t-1}V_x + P_x)(1 + i) - (S_x) \left(1 - \frac{q_x^d}{2} - \frac{q_x^w}{2}\right) \left(1 + \frac{i}{2}\right) = (1 - q_x^d - q_x^w)({}_tV_x).$$

$P_x$  = Net level premium to age 56 for a \$10 daily hospital benefit (90-day maximum) based on actuarial assumptions outlined below.

${}_tV_x$  = Terminal reserve factor per unit based on realistic assumptions.

$S_x$  = Net annual claim cost based on the male 1974 Hospital Table published by Nelson and Warren, Inc., with underwriting selection factors as follows:

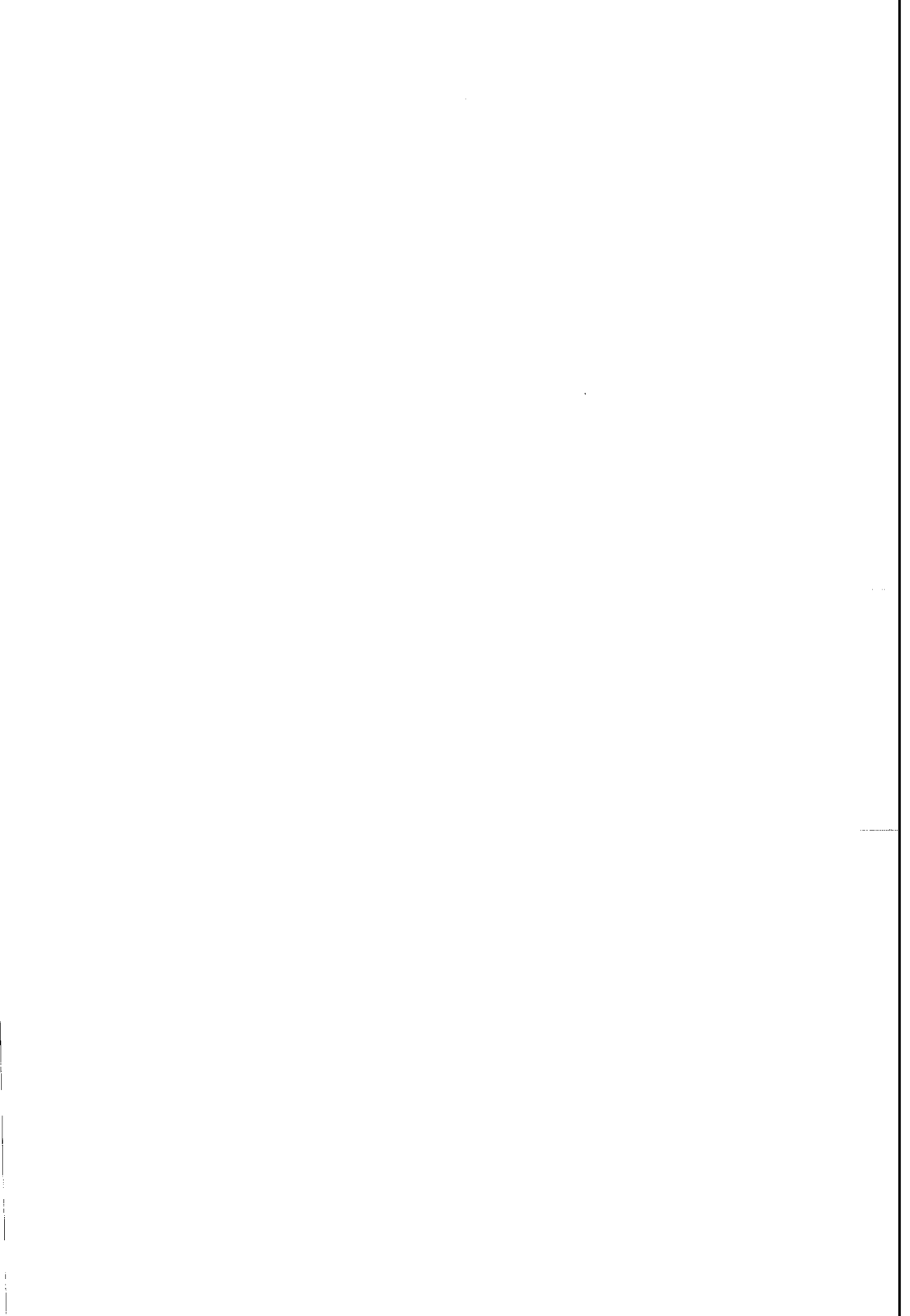
Policy Year	Percentage of 1974 Hospital Table
1 . . . . .	70%
2 . . . . .	80
3 . . . . .	85
4 . . . . .	90
5 and later . . . . .	95

$q_x^d$  = Mortality rate based on the 1965-70 Ultimate Basic Mortality Table for males (age nearest birthday).

$q_x^w$  = Withdrawal rate as follows:

Policy Year	Withdrawal Rate
1 . . . . .	30%
2 . . . . .	20
3 . . . . .	15
4 . . . . .	10
5 and later . . . . .	5

$i$  = 6 percent.





## DISCUSSION OF PRECEDING PAPER

CLAUDE Y. PAQUIN:

The development of the tables in Mr. Pharr's paper shows (with the assistance of the paper's Appendix I) that the loss ratio formula favored by the author is the following:

$$\begin{aligned} \text{Loss ratio} = & \frac{1}{P_t} \left\{ \frac{i}{1+i} \left[ {}_{t-1}V_x - \frac{1}{2} S_t \left( 1 - \frac{q_t^d}{2} - \frac{q_t^w}{2} \right) \right] \right. \\ & \left. + \frac{1}{1+i} \left[ S_t \left( 1 - \frac{q_t^d}{2} - \frac{q_t^w}{2} \right) + (1 - q_t^d - q_t^w) {}_tV_x - {}_{t-1}V_x \right] \right\}, \end{aligned}$$

where the terminal reserve factors are those for natural reserves (referred to as "realistic" in the paper),  $P_t$  represents the premium income as of the beginning of policy year  $t$ , and a policy-year approach is being considered for the computation.

One might observe the anomalous use of an annual premium payable at the beginning of the policy year in a demonstration contemplating lapses occurring uniformly during the policy year, but this does not affect the reasoning involved.

The first term of the formula, and the effect of the  $1/(1+i)$  modification to the second term, are conceived of by the author as interest adjustments. It is interesting to discover that the foregoing formula, after a minor manipulation, amounts simply to

$$\begin{aligned} \text{Loss ratio} = & \frac{1}{P_t} \left[ v^{1/2} \left( 1 - \frac{q_t^d}{2} - \frac{q_t^w}{2} \right) S_t \right. \\ & \left. + v(1 - q_t^d - q_t^w) {}_tV_x - {}_{t-1}V_x \right], \end{aligned}$$

which presents a view of the loss ratio, as of the beginning of the policy year, as being the discounted value of incurred claims and of the increase in reserves, divided by the value of the earned premiums.

Where reserves other than natural reserves are inserted in the formula, or where actual claims are substituted for expected claims, or where one element is discounted and another is not, loss ratios can begin to fluctuate (as the paper illustrates) and to lose meaning.

Perhaps it would have been helpful to distinguish clearly between annual and lifetime loss ratios, and, with respect to lifetime loss ratios,

between prospective (expected) loss ratios and retrospective (actual) loss ratios. As of any specific time within the life of a group of policies, it is possible to compute (a) the sum of actual past incurred claims and of expected future claims, (b) the sum of actual past premium income and of expected future premium income, and (c) the ratio of *a* to *b*, serving as a composite, emerging loss ratio.

This composite loss ratio may indicate the reasonableness of the premiums (charged to date as well as remaining to be charged) as long as normal actuarial methods of accounting for interest and survivorship are used, both retrospectively and prospectively.

Perhaps the first question that should be asked is, "What are we trying to accomplish with loss ratios?" The meaninglessness of loss ratios as they have been used traditionally can be seen from an attempt to apply them to life insurance (which is nothing but a special case of health insurance).

Mr. Pharr states his perception that "there is a great need for uniform specifications for the development of individual accident and health loss ratios." I could not disagree more. Uniform specifications mean more regulation. More regulation is what we do not need and do not want, at least not if the regulation is not essential. Let us first ask whether we need loss ratios, and what for. If those questions can be answered satisfactorily, the "uniform specifications" should suggest themselves. There is, in my opinion, a strong possibility that (a) the need for a reliable mechanism for determining the reasonableness of individual health insurance premiums will be perceived clearly and (b) traditional loss ratios will form no part of that mechanism. The current loss ratio dilemma might come from not being too sure of our destination and looking at the wrong road map.

W. H. ODELL:

Mr. Pharr has done his usual fine job of shedding light in darkness. His paper is very timely. There is a great deal of confusion surrounding the subject of loss ratios.

We actuaries need to be reminded of "the rather significant misconceptions and distortions commonly encountered in the use of individual accident and health insurance loss ratios," and the paper indeed serves as such a reminder. The tables contained in the paper enhance its readability and usefulness in practical application. The paper emphasizes, appropriately, the significance of the choice of loss ratio formula, assumptions, and definitions of terms.

This discussion addresses certain other topics related to the loss ratio dilemma (considering, at least for illustrative purposes, group as well as individual insurance), namely:

- I. Factors affecting loss ratios
- II. Examples of variation in loss ratios
- III. Comments on some aspects of loss ratio interpretation
- IV. Reasons for confusion surrounding loss ratios
- V. 1979 Annual Statement
- VI. Other matters

A glossary of terms appears at the end of this discussion.

The comments below relate to some significant matters concerning the topics listed. They are by no means a complete treatment of the subjects addressed.

### I. *Factors Affecting Loss Ratios*

These factors include not only the selection of the loss ratio formula and definition of the terms used in the formula but also matters concerning the insurance coverage for which the loss ratio is being calculated, the operation of the insurer providing the coverage, and the environment in which the insurance operations are conducted.

1. *Type of reserve.* The paper is a most adequate demonstration of the fact that the choice of reserve method has a profound effect on the loss ratio results. The choice between two-year preliminary term and net level, the choice of whether or not to consider withdrawals, and other factors have a significant impact.
2. *Assumptions used to compute reserves, and the relation of such assumptions to actual experience.* Again, the paper presents most adequate support of the impact of this factor upon the results.
3. *Formula used to compute loss ratios.* As Mr. Pharr points out, the change in active life reserves is usually considered a benefit cost by life actuaries, but a premium modification by casualty actuaries. The choice of formula—and a number of formulas have been used—obviously affects the results.
4. *Distribution of in-force by duration.* The impact of this distribution will depend upon other factors. For example, considering only the reserve method, if the two-year preliminary term method is used, then a pattern of rapidly increasing issues will tend to exhibit relatively low loss ratios, while a runoff situation will tend to produce higher loss ratios. (See Table 3 of the paper.)
5. *Type of risk assumed.* The lower the degree of variability between claim costs and premium for a particular coverage, the higher the loss ratio for that coverage that may be economically sound for the insurer. For example,

the relationship has relatively little variability for many group coverages. It has a high degree of variability for some other coverages that traditionally have low loss ratios. This factor is specifically recognized in the regulations of some states.

6. *Expenses.* The higher, relative to premium, the level of expense required to sell and service a coverage, the lower the loss ratio for that coverage that may be economically feasible for the insurer. The cost of having a trained salesperson present to explain a plan of insurance to a prospective customer for an individual (including family) policy is relatively greater than for a group policy.
7. *Provisions with regard to renewability.* The shorter the term of the contract, the higher the loss ratio that may be economically sound for the insurer. Long-term policies under which the insured is guaranteed the right to renew often display lower loss ratios than one-year term contracts. The stronger the renewal guarantee, if any, the more the insurer is exposed to the risk that actual experience will be significantly worse than is assumed in the premium rates.

The above factors fall into two groups:

- a) *Spurious factors:* Factors 1, 2, 3, and 4 fall into this category. They lead to spurious differences between loss ratios. Whatever the "real" loss ratio might be, the loss ratios calculated using different methods and assumptions are different. The important point is that the methods and assumptions have nothing to do with the relationship being measured. Therefore, the differences in results caused by these factors are apparent, not real.
- b) *Service factors:* Factors 5, 6, and 7 fall into this category. These are called service factors because, for a well-managed insurer operating in a sound market, they can be expected to be responsive to the extent of services, other than benefit payments, provided to the insured. However, it must be understood that these factors often are affected by causes other than the services provided. These factors affect the portion of the premium required to provide services to the insured. Obviously, the greater the portion of the premium that is required for the various services, the smaller the portion that will be available for benefit costs, and vice versa. Hence, these factors affect loss ratio results in a real but indirect way.

## II. *Examples of Variation in Loss Ratios*

Appreciation of the operation of the above factors is enhanced by considering actual results. Three examples follow, with comments relating each example to the above factors.

**EXAMPLE 1:** *Variation caused by spurious factors.* Consider the following loss ratios, all of which relate to the business of the same company but which have been calculated for different purposes:

YEAR	LOSS RATIO (%) CALCULATED FOR		
	Form 10-K	Schedule H Footnote	Accident and Health Policy Experience Exhibit
1976.....	56.8%	45.1%	39.0%
1977.....	59.4	51.8	43.3
1978.....	63.6	60.5	48.8

The entire variation among the loss ratios is caused by the spurious factors; the real variation within each year is, of course, zero, since the same thing is being measured by each loss ratio.

The Form 10-K loss ratios are determined from reserves that are based on the net level premium method and utilize assumptions appropriate to GAAP reserves. The Schedule H loss ratios are determined from reserves that are based on the two-year preliminary term method and utilize assumptions appropriate to statutory reserves (including no withdrawals). The Accident and Health Policy Experience Exhibit loss ratios use the change in active life reserves as a premium adjustment (rather than a claim cost as for the other two loss ratios). The formulas for the last two ratios are discussed below.

**EXAMPLE 2:** *Variation of loss ratios caused indirectly by service factors.* The following table shows loss ratios for five different companies as taken from Schedule H for 1978:

COMPANY	LOSS RATIO (%)		% BY WHICH GROUP LOSS RATIO EXCEEDS GUARANTEED RENEWABLE LOSS RATIO
	Individual Guaranteed Renewable	Group	
1.....	62.9%	84.0%	33.5%
2.....	61.4	73.5	19.7
3.....	56.7	74.5	31.4
4.....	65.9	82.6	25.3
5.....	58.3	89.0	52.7

The variation in the service factors—risk, expense, and renewability—is great indeed between the individual guaranteed renewable and group lines of business. Therefore, it is reasonable to suppose that the significant variations demonstrated above between these lines of business are due for the

most part to service factors. Of course, the level of each reported loss ratio and the variations of the loss ratios within line of business among companies are doubtless due in some part to spurious factors.

**EXAMPLE 3:** *Variation of loss ratios caused by a combination of spurious and service factors.* This example relates to variation among companies within a line of business. Among the twenty-six companies with the largest premium income for 1978, the Schedule H loss ratios for the guaranteed renewable line showed the following variation:

a) Lowest loss ratio.....	39.5%
b) Highest loss ratio.....	70.9
c) Ratio of b to a.....	179

Usually, there are variations by company in reserve methods, reserve assumptions, and the distribution of in-force business by duration. Therefore, we can be reasonably confident that spurious factors are causing at least part of the variation shown above. Also, patterns of service vary among companies, even within the guaranteed renewable line of business. Hence, we are entitled to conclude that service factors also are at work. Therefore, the fact that the loss ratio of one company is 179 percent of that of another company is a fact that must be approached with considerable caution. This leads to the next subject, loss ratio interpretation.

### III. *Comments on Some Aspects of Loss Ratio Interpretation*

A loss ratio is intended to measure part, and only part, of the total package of services provided by an insurer. It is intended to measure the relationship between amounts of money utilized to provide benefits and amounts of money received as premium revenue. It is *not* designed to measure other elements of the total package of services, such as guarantees as to renewability, guarantees as to the insurer's right to change premium rates, personal services the insurer undertakes to provide to the insured, and so forth.

In interpreting a loss ratio, or variations among loss ratios, one should first determine the extent to which spurious factors are involved. If we are faced with a set of data such as that given in example 1 above, then we know that spurious factors are at work. In practice it often is not clear whether spurious factors are involved. In these situations the only safe course is to assume that spurious factors are involved until evidence indicates otherwise. Usually even this preliminary step requires at least an examination of a few consecutive years' annual statements. To the extent that spurious factors are present, recalculations should be made on a satisfactory basis; otherwise, interpretations are likely to be doubtful and comparisons are very likely to be misleading. For many

comparisons it will be found that the only satisfactory approach is to work with basic data and calculate loss ratios on a satisfactory basis.

A second step in interpreting a loss ratio, or variations among loss ratios, is an analysis of the extent to which service factors are involved. Returning to example 2 above, suppose (the following percentages are purely hypothetical, although the data given in the example are actual) that 90 percent of the business of Company 3 is group and 10 percent is individual guaranteed renewable, and that 10 percent of the business of Company 4 is group and 90 percent is individual guaranteed renewable. Suppose further that we are told that Company 3 has a higher loss ratio, namely, 72.72 percent, than Company 4, which has a loss ratio of 67.57 percent. Considering only the two loss ratios, it appears that, given comparable situations, Company 3 returns more premium to policyholders in the form of benefits than Company 4. There is no way of knowing whether service factors are creating the difference or whether the situations are comparable. Of course, once the loss ratios by line of business, and the distribution of in-force by line of business, are considered, the picture changes considerably. It then appears that the opposite is more likely true, namely, that in comparable circumstances Company 4 returns a higher portion of the premium in benefits than Company 3. Of course, we should not trust even this new result without analyzing the impact of each of the factors on each loss ratio used in the comparison and the way in which these factors vary among companies within a line of business.

In any event, interpreting a loss ratio or comparing loss ratios requires an appreciation of all services provided by the insurer. Only in this manner may the portion of premium available for benefits be considered in correct perspective.

Finally, the interpretation may take at least a preliminary step toward evaluation. At this stage all spurious factors will have been eliminated and service factors will have been identified. The process of evaluation implies comparison. Two situations are possible. First, there is the situation in which *service factors are not comparable*. The effect on a loss ratio of service factors is real; however, the variation among loss ratios caused by these factors is spurious for most purposes for which loss ratios are calculated, although it is real for some purposes for which loss ratios are calculated. It is only by careful definition of the *purpose* for which a loss ratio calculation and comparison are made that one can determine whether the variation among loss ratios caused by service factors is spurious or real.

Suppose we are asked whether a company is doing a better job of paying benefits to policyholders under its Form A or under its Form B. Calculations are made, and it turns out that the loss ratio for Form A is higher than that for Form B. Comparison of the loss ratios is meaningless, because the difference between the two loss ratios is spurious for the purpose for which the calculation is made. If the question is changed slightly, however, so that we are asked under which of the two policy forms the company returns the greatest portion of premiums to the policyholders, the comparison of these loss ratios becomes meaningful.

Similarly, in example 2, Company 1 is not necessarily doing a better job for its group policyholders with a loss ratio of 84.0 percent than it is for its individual guaranteed renewable policyholders, for whom the loss ratio is 62.9 percent. The individual policyholders have a different package of services than the group policyholders.

Yet another problem associated with loss ratio interpretation should be noted here. It is that there appear to be two assumptions often used implicitly in loss ratio interpretation, namely, that any two loss ratios may be compared, and that the higher the loss ratio the better.

In the second situation, that in which *service factors are comparable*, comparison of loss ratios where no spurious factors are present provides an opportunity to make a meaningful comparison with regard to the portion of premium being returned to policyholders in the form of benefits. The comparison may be with a benchmark, among policy forms of the same company, or between companies. Variance in the service factors may be present to a very small degree and may not mitigate a meaningful comparison. Loss ratios calculated on a realistic basis such as that suggested in the paper for blocks of business providing comparable packages of service should produce more of these comparisons for use by interested parties in the future than have been available in the past.

#### IV. *Reasons for Confusion Surrounding Loss Ratios*

##### A. FORMAT OF SCHEDULE H OF THE ANNUAL STATEMENT FOR 1978 AND PRIOR YEARS

This schedule presents two types of loss ratios. One is the loss ratio familiar to casualty actuaries, which treats the increase in advance premiums and active life reserves as a reduction of premiums written and divides these reduced premiums into incurred claims. This ratio is shown on line 15d for coverages that are usually considered short term: group, credit, other accident only, and all other, and in the total column for all coverages combined. The second type reflects the long-term



nature of the coverages for which it is presented: collectively renewable, noncancelable, and guaranteed renewable. For these coverages, the place on line 15d where loss ratios would otherwise appear is "x-ed out," and the required loss ratios are shown in a footnote. Each ratio is the quotient of incurred claims plus the increase in advance premiums and active life reserves, divided by premiums written.

The essence of the difference between these two types of loss ratios is that the increase in advance premiums and active life reserves is subtracted from the denominator in the former and added to the numerator in the latter. This format has caused confusion for at least two reasons:

1. The loss ratio for all accident and health business combined (long-term and short-term coverages combined) apparently has been assumed by some users of the statement to be representative of all of a company's business, even though the designers of this schedule clearly specified a different loss ratio for the long-term business.
2. The relegation of the loss ratios for long-term business to a footnote has apparently led to their being almost universally overlooked.

#### B. ACCIDENT AND HEALTH POLICY EXPERIENCE EXHIBIT FOR 1978 AND PRIOR YEARS

This exhibit has utilized the first of the two types of loss ratios mentioned in Section A above. The ratio is shown for each of the most significant policy forms and in total. Quite naturally this display has given further impetus to this type of loss ratio, designed for short-term coverages, being quoted for the longer-term coverages simply because it is the only type of loss ratio shown in this exhibit.

#### C. CERTAIN PRACTICES IN LOSS RATIO INTERPRETATION

It appears that certain practices have come into rather wide use in loss ratio interpretation and are contributing significantly to the confusion surrounding loss ratios. They are the following:

1. The assumption that any loss ratios may be compared. It appears that loss ratios from widely different sources are often gathered together on the assumption that they are comparable. The urge to assume that any two loss ratios may be compared seems quite strong when they appear in the same publication, and becomes overwhelming as soon as the numbers are put on the same page.
2. The assumption that "the higher the loss ratio the better." The pervasiveness of this assumption can be appreciated by asking what has appeared in print expressing concern that the financial well-being of policyholders is not well served if the long-term financial soundness of a company is im-

paired because for a long period of time its loss ratios are higher than is economically sound under the circumstances. How much concern is expressed that a reasonable portion of the premium must accrue to gain from operations if the insurance industry is to continue to formulate and develop new ways of meeting the needs of the public and formation of new enterprises is to be encouraged?

3. The use of data without full understanding. It would appear that loss ratio data, especially those published in the annual statement, have been used without full understanding of either the phenomena being measured or the mathematical techniques underlying the calculation. This paper should make such occurrences less frequent in the future. The 1979 Annual Statement format should also help considerably.

#### V. 1979 Annual Statement<sup>1</sup>

##### A. ACCIDENT AND HEALTH POLICY EXPERIENCE EXHIBIT

The exhibit, reproduced in Appendix I, is discussed before Schedule H because the changes in this exhibit probably will have the greatest effect in reducing the confusion surrounding loss ratios. A column of this exhibit requires ratios of "incurred claims and increase in policy reserves" to "premium earned."

It is important that the Accident and Health Policy Experience Exhibit now will show loss ratios based on formulas appropriate to each policy form or group of policy forms analyzed by that exhibit. The numerator of the ratio for long-term coverages will take account of the change in additional reserves. Where such reserves are not held, as is usually the case for short-term coverages, there is no such change to be reflected in the numerator. Those quoting loss ratios from Annual Statement data no longer will face the confusion for long-term coverages between the exhibit data, on the one hand, and Schedule H data, on the other.

##### B. CHANGES IN SCHEDULE H

Changes in Schedule H (reproduced in Appendix II) particularly pertinent to this discussion are the following:

1. The same loss ratios are shown for all types of business.
2. There are no longer any loss ratios shown in the footnotes.
3. The denominator is now the same for all lines of business, and is the same as the denominator used in the Accident and Health Policy Experience Exhibit loss ratios. It is called "premiums earned." It is not the same as the denominator of either of the loss ratios used in the 1978 Annual State-

<sup>1</sup> For a full discussion see Charles M. Beardsley, *New Items in the 1979 Annual Statement for Life Insurance Companies* (Winston-Salem, N.C., 1980).

ment. It is not the same as the quantity designated "earned premium" in the 1978 statement.

4. Two loss ratios are presented, instead of one, to reflect the company's benefit costs. First, the ratio of incurred claims to premiums earned is shown in Part 1, line 3; second, the ratio of increase in policy reserves to premiums earned is shown in Part 1, line 4.
5. The two loss ratios mentioned above can be added together to determine the total benefit cost to the company compared to premiums.
6. The sum of the two loss ratios is comparable in total to the loss ratio shown in the Accident and Health Policy Experience Exhibit.

#### C. STATEMENT FOR FIRE AND CASUALTY COMPANIES

The Annual Statement for fire and casualty companies is generally the same but has minor variations.

#### VI. *Other Matters*

Certain matters related to the loss ratio dilemma deserve mention, and some suggestions for further investigation appear in order.

1. There is some question whether the publication of loss ratios as specified in the Annual Statement is helpful. The new formats adopted in 1979 are a significant improvement. However, the question remains whether publication of results of the present type is, in at least some cases, so misleading that it should be stopped. A minimum step would seem to be the use of net level reserves (as opposed to one-year preliminary term or two-year preliminary term) in all Annual Statement loss ratio calculations. The paper shows that this is not a panacea, but it might be enough of a step forward to reduce significantly the extent to which loss ratios presently published in the Annual Statement are misleading with respect to some lines of business.
2. The following further modification of the Accident and Health Policy Experience Exhibit might be useful: Retain the present overheading of columns 4 and 5. Change the subheading of column 4 to "Amount minus Reserves on Statement Basis" and the subheading of column 5 to "Amount minus Reserves on Net Level Basis." Then add the following columns: (a) column 5A—"Interest Adjustment Corresponding to Column 5"—and (b) column 5B—"Column 5 Adjusted by Column 5A as a Percentage of Premiums Earned." The loss ratio that would be exhibited in the last of these three columns appears to fall short of a realistic loss ratio as advocated in the paper only to the extent that the valuation assumptions used to determine the statutory reserves and liabilities vary from "realistic." If such a change were made, changes in the format of Schedule H would be required.
3. There are various ways of looking at loss ratios: from the point of view of the insurers, from the point of view of the regulators, and from the point of view of the consumer. Others are investigating this topic.

4. The technique employed in the paper for handling interest, which is in effect to eliminate the interest impact on the loss ratios of a given period, is convenient and easy to follow. The interest area can be fraught with difficulties.
5. Our attention to the loss ratios of a given time period should not distract us from the fact that, for rate-making and certain other purposes, the focus should be on the loss ratios over the lifetime of a block of business or, in any event, over a much longer time than one accounting period.
6. The subject of variance in loss ratio statistics deserves additional attention.

The loss ratio dilemma has not been solved. However, Mr. Pharr's paper has done much to communicate that dilemma and has made significant steps toward its solution.

#### GLOSSARY<sup>2</sup>

**ANNUAL STATEMENT.** Life and Accident and Health Insurance Company Annual Statement Blank unless context indicates another meaning.

**PREMIUMS WRITTEN.** Premiums due during accounting period.

**PREMIUM RESERVES.** Unearned premiums plus advance premiums plus reserve for rate credits.

**POLICY RESERVES.** Additional reserves plus reserve for future contingent benefits.

**ACTIVE LIFE RESERVES.** Unearned premium reserve plus additional reserve plus reserve for future contingent benefits plus reserve for rate credits; equals premium reserves less advance premiums plus policy reserves.

**INCURRED CLAIMS.** Claims paid plus increase in claim liability plus increase in claim reserve during accounting period.

**PREMIUMS EARNED.** Premiums written less increase in premium reserves.

**LINE OF BUSINESS.** As indicated by a column of Schedule H of the Annual Statement—group, credit, collectively renewable, noncancelable, guaranteed renewable, and so on.

<sup>2</sup> The definitions given conform to Schedule H of the Life and Accident and Health Insurance Company Annual Statement for 1979. Schedule H for 1978 and prior years employs different definitions.

# APPENDIX I

Date of filing: This exhibit is required to be filed not later than June 30

## ACCIDENT AND HEALTH POLICY EXPERIENCE EXHIBIT FOR YEAR 19.....

MADE BY .....

(Name)

Policy Form Number	Class Code	Type of Policy	Premium Earned (see item 1)	Payment Claims and Expenses on Policy Expirations		Commissions Earned	Rate of Cancellations and Expirations	Percentage of Policies Not Renewed
				Amount	Number of Policies Expiring			
			1	2	3	4	5	6

### A. GROUP AND CERTAIN INDIVIDUAL POLICIES

Group								
Comments: Premiums \$1.50 or less per person annually (i.e. by Policy Form)					XXX			XXX
Sub-Total								

### B. CREDIT (GROUP & INDIVIDUAL)

Sub-Total								

### C. HOSPITAL, MEDICAL & SURGICAL POLICIES

COLLECTIVELY RENEWABLE								
1. MASS UNDERWRITING BASIS					XXX			XXX
					XXX			XXX
					XXX			XXX
2. OTHER					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
NON-CANCELLABLE					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
GUARANTEED RENEWABLE					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
NON-RENEWABLE FOR STATED REASONS ONLY					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
OTHER ACCIDENT ONLY					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
ALL OTHER					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								

### D. LOSS OF TIME POLICIES

COLLECTIVELY RENEWABLE								
					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
NON-CANCELLABLE					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
GUARANTEED RENEWABLE					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
NON-RENEWABLE FOR STATED REASONS ONLY					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
OTHER ACCIDENT ONLY					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
ALL OTHER					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								

### E. ALL OTHER POLICIES

COLLECTIVELY RENEWABLE								
					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
NON-CANCELLABLE					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
GUARANTEED RENEWABLE					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
NON-RENEWABLE FOR STATED REASONS ONLY					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
OTHER ACCIDENT ONLY					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
ALL OTHER					XXX			XXX
					XXX			XXX
					XXX			XXX
Sub-Total								
TOTAL DIRECT BUSINESS								
REINSURANCE ASSUMED LESS CEDED								
TOTALS (to agree with annual statement)								

Number of Accident and Health Policies in Force at End of Year: (Include) .....

Number of Accident and Health Policies in Force at End of Year: (Exclude) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

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Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Include) .....

Number of Accident and Health Policies in Force at End of Year: (Exclude) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

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Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Include) .....

Number of Accident and Health Policies in Force at End of Year: (Exclude) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

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Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Number of Accident and Health Policies in Force at End of Year: (Total) .....

Form 1979

1. Premiums earned are before adjustments for the increase in policy reserves which has been treated as a separate deduction.

## APPENDIX II

ANNUAL STATEMENT FOR THE YEAR 1979 OF THE

Form 1

(Name)

### SCHEDULE H — ACCIDENT AND HEALTH EXHIBIT

	1		2		3		4		5				6				7				8		9	
	Total		Group Accident and Health		Credit* (Group and Individual)		Collectively Renewable		Non-Cancelable		Guaranteed Renewable		Non-Renewable for Specified Reasons Only		Other Accident Only		All Other							
	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>	Amount	% <sup>1</sup>		
<b>PART 1 — ANALYSIS OF UNDERWRITING OPERATIONS</b>																								
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
<b>PART 2 — RESERVES AND LIABILITIES</b>																								
A																								
1																								
2																								
3																								
4																								
5																								
6																								
B																								
1																								
2																								
3																								
4																								
5																								
C																								
1																								
2																								
3																								
<b>PART 3 — TEST OF PREVIOUS YEAR'S CLAIM RESERVES AND LIABILITIES</b>																								
1																								
a																								
b																								
2																								
a																								
b																								
3																								
a																								
b																								
c																								
<b>PART 4 — REINSURANCE</b>																								
A																								
1																								
2																								
3																								
4																								
B																								
1																								
2																								
3																								
4																								

\* Business not exceeding 120 months duration  
 The each column of Part 1, show the percentages of Line 2 for Lines 3 through 13 inclusive

Includes 1 reported as Policy membership and other fees obtained by agents  
 if not included in claim reserves.  
 (2) Premiums earned are before adjustment for the increase in policy reserves which has been treated as a separate deduction

## E. PAUL BARNHART:

Joe Pharr has contributed a very useful paper analyzing the distorting effects of various types of active life reserve and investment income adjustments in determination of the loss ratio. The paper clearly illustrates the relative effects of various such adjustments on loss ratios for successive policy years, and should be of help to those who must attempt to understand and interpret loss ratios derived by any of these methods.

I want to comment on several basic points. In the first place, I think that any discussion of the proper method of determining a loss ratio must take directly into account the anticipated loss ratio that must be determined and submitted along with any premium rate filing with insurance departments. The method of measuring actual experience loss ratios from time to time should be consistent with the method used to derive the *anticipated* loss ratio, since the latter is the basis declared in the rate filing as the guideline by which the reasonableness of premiums in relation to benefits is to be judged. I consider any other basis to be misleading, and in some cases even unethical.

If the anticipated loss ratio was determined as the ratio of the present value at issue of expected benefits to the corresponding present value at issue of expected premiums, then actual loss ratio results should be determined in a manner consistent with this definition. Assuming that both present values were determined using the same array of gross premium assumptions (as they should be), then the anticipated loss ratio is simply the ratio of the benefit net premium to the gross premium, calculated on those assumptions. In Joe's paper, this would be the loss ratio from Table 7, 53.6 percent, if both premiums are presumed to have been calculated on the Table 7 assumptions.

If the benefit net and/or gross premiums were determined on *other* assumptions, then the Table 7 approach (or any other method described in the paper) would be inappropriate, unless it or one of the other methods described could be deemed to be a sufficiently close approximation to the true basis.

In the conclusion to the paper, Joe states that "there is a great need for uniform specifications for the development of individual accident and health loss ratios." I agree with this, but I believe that any such specifications must *begin* with a clear definition as to how the anticipated loss ratio is to be determined in the first place, along with the corollary specification that subsequent reported experience loss ratios be measured on a basis consistent with this definition. In my opinion, any actuarially appropriate definition should be of the "present value at

issue" type referred to above, which means that the corresponding present values must be derived using a realistic rate of discount.

The original NAIC guideline of 1953, specifying a 50 percent loss ratio, failed really to define how such a loss ratio is to be obtained. In view of the customary loss ratio tests provided for in the Annual Statement Blank since that time, it would appear that no present-value discounting or alternative accumulation at interest was intended—that is, that the implied interest rate is zero. More recently, several states, beginning, I believe, with New York, have specified present-value definitions for the anticipated loss ratio. It should be recognized that under most level premium health insurance plans involving rising claim costs, a present-value loss ratio will be *lower* than a zero interest loss ratio otherwise calculated on the same assumptions. Thus, if 50 percent were the established guideline for a given class of business on the zero interest basis, something lower, for example, 45 percent, might be the equivalent level, representing an equal standard, under a present-value definition. By retaining 50 percent as the guideline value, under a present-value definition, insurance departments actually have rendered the 50 percent guideline generally more stringent than was the case before. I am not sure how clearly this rather subtle shift has been recognized.

The inference I draw from reading the paper is that valid measurements of experience loss ratios *require* determination of active life reserves on a realistic basis, in order to level out the loss ratio. Such additional reserve calculations are not, however, actually necessary. It is quite possible to start from projected yearly incurred claim ratios such as Joe shows in column 1 of Table 3, and from these develop *cumulative* expected loss ratios up through the *n*th policy year, entirely without relevance to reserve changes. Such cumulative figures should incorporate the lapse and investment income assumptions. Then *actual* cumulative incurred claim ratios may be determined on a comparable basis up through year *n*, as the experience emerges, and these results compared with expected in the form of actual-to-expected cumulative ratios. Such actual-to-expected ratios usually suffice to determine how closely emerging experience is reflecting the anticipated loss ratio, and whether any rate adjustment is called for. No adjustment for reserves is really needed in either the expected or the actual figures. This method has the double advantage of (1) avoiding the considerable task of determining the assumptions and making the calculations as to "realistic" reserves and (2) making it possible to monitor the relation of actual to expected experience from the very first year, long before it becomes possible to



establish credible experience assumptions for reserves with any confidence. The result will be earlier and more dependable "early warning" than is possible using any system that must wait upon reserve calculations based on assumptions adjusted to actual experience. This simpler method is also more appropriate to smaller volumes of business, where credible trends and loss levels are difficult to establish for purposes of adopting reserve assumptions.

(AUTHOR'S REVIEW OF DISCUSSION)

JOE B. PHARR:

Claude Paquin, Bill Odell, and Paul Barnhart have been interested enough in the subject matter of this paper to submit written discussions, and the author wishes to thank each of them for such interest. Their remarks add considerably to the paper's perspective. Bill Odell's and Paul Barnhart's encouraging remarks in their written discussions are particularly gratifying to the author.

Claude Paquin's suggestion that any discussions of meaningful loss ratios should focus on (1) retrospective loss ratios that indicate the reasonableness of premiums already charged and (2) prospective loss ratios that suggest the reasonableness of premiums remaining to be charged is quite helpful and an excellent addition of the theme of the paper. It was not the intention of the author to give rise to "more regulation," as Claude suggests would occur with any call for more uniform specifications as to the development of individual accident and health loss ratios. The author believes that the widespread use of loss ratios is an inherent part of the individual accident and health business and its regulation, with or without the approval of actuaries. A suggestion of uniformity is intended solely to result in clarifications where considerable confusion exists and to make such ratios more meaningful to insurance company management and regulators.

Bill Odell's real world examples of actual experiences of a single underwriter, for the same period of time, where noticeably different loss ratios for the same block of business are available to the public from the SEC Form 10-K, the Annual Statement Schedule H footnotes, and the Accident and Health Policy Experience Exhibit are excellent, and are welcome additions to the theme of the paper. Bill also points to recent revisions of the loss ratio calculation methodology in the Annual Statement Schedule H, which revisions are expected to be embraced by health insurance actuaries and should significantly reduce the confusion (state

of dilemma) surrounding loss ratio presentations. Bill's discussion expands considerably on the theme underlying the paper, and his remarks undoubtedly will be of interest to students of the subject matter of this paper.

Paul Barnhart's point, that the method of measuring actual experience loss ratios from time to time should be consistent with the method used to derive the anticipated loss ratios, is timely and is an excellent one. He considers any other basis misleading, and even unethical. Paul apparently prefers to calculate such loss ratios on a present-value basis. Several years ago the author began a consulting practice of calculating anticipated loss ratios using a format that could be compared readily with developing experience. The approach follows that illustrated in columns 4 and 5 of Table 3 of the paper. It is believed that a company can readily develop details as to incurred claims and reserve changes for ratioing to earned gross premiums, for broad three-to-five-issue-year groups, without too much difficulty, so that in aggregate the grouped years of experience could be traced back to the experience loss ratios in the Accident and Health Policy Experience Exhibit. It was not an intended inference of the paper that valid measurements of experience loss ratios required determination of active life reserves on realistic bases. Realistic reserve changes were used to illustrate circumstances where annual loss ratios are constant each year over the lifetime of the business and, as such, might be considered the benchmarks that broadly underlie anticipated loss ratio regulations. However, given the present anticipated loss ratio climate, the established use of loss ratios in exhibits filed with regulatory authorities, and the interest of such states as Massachusetts in correlations between data filed with the states and data used to support premium filings, it seems to the author that actuaries should help to establish more appropriate and actuarially sound reflections of active life additional reserve changes in the loss ratio calculations than have been provided in past practices.