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DEVELOPMENT OF THE 1974 MEDICAL EXPENSE TABLES

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ABSTRACT

This paper describes the development of the net annual claim costs, net premiums, and reserve factors that comprise the 1974 Medical Expense Tables. These tables were prepared for use in the statutory valuation of individual hospital and medical insurance policies. For the most part, the underlying experience is derived from the *Transactions of the Society of Actuaries, 1972* and *1974 Reports Numbers*. For those benefits for which intercompany experience is not available, other statistical data were used to derive the basic net annual claim costs. The paper contains tables of net annual claim costs for eighteen benefits and discusses the derivation of approximate values for other benefits.

I. INTRODUCTION

Overview and Historical Background

In November, 1956, Task Force 4 of the Joint Committee on Health Insurance submitted a report to the National Association of Insurance Commissioners (NAIC) recommending reserve tables and procedures for medical expense policies, disability income policies, and miscellaneous accident and health benefit policies. Among these tables were the 1956 Intercompany Hospital and Surgical Tables and the Conference Modification of the Class III Disability Table. Task Force 4 also described the types of policies for which reserves would be required and recommended valuation procedures to be used for such policies. Since that time, the 1964 Commissioners Disability Table has been introduced and has replaced the Conference Modification of the Class III Disability Table as the standard for valuing disability income policies. However, no tables to replace the 1956 Intercompany Hospital and Surgical Tables have been constructed and promulgated. For policies providing such benefits as major medical expense, cancer expense, and medicare supplementary expense, no table has been promulgated by the NAIC as a recommended valuation basis. In 1965 Nelson and Warren, Inc., published a volume that includes reserve tables for hospital

and surgical benefits based on the 1956 Intercompany Hospital and Surgical Tables; this volume also contains major medical reserves based on the intercompany experience reported in the *Transactions of the Society of Actuaries, 1963 Reports Number.*

In recent years many actuaries have found themselves in the position of having to determine reserves for hospital, surgical, and medical benefits either by using tables that are out of date or by designing specially calculated reserve factors based on their best estimate of morbidity experience. There is a clear need for the industry to have available in published form reserve tables based on current morbidity experience that can be used for the valuation of major medical, hospital, surgical, cancer, and medicare supplementary benefits when these benefits are provided under guaranteed renewable policies. The new NAIC actuarial certification, which requires actuaries to certify that the reserves included in the annual statement not only meet statutory minimum standards but are adequate to cover the policy liabilities, emphasizes the actuary's responsibility to examine critically the adequacy of existing valuation standards.

In November, 1976, Tillinghast, Nelson and Warren, Inc., published a three-volume set of reserve tables, which, for the purposes of this paper, are entitled the 1974 Medical Expense Tables. These tables contain commutation functions, net annual claim costs, net single premiums, net annual premiums, and two-year preliminary term midterminal reserve factors for individual medical expense benefits. Net premiums and reserves are based on the developed claim costs combined with the 1958 Commissioners Standard Ordinary (1958 CSO) Mortality Table and 3 percent interest. For most benefits the net premiums and reserves are shown for both a term-to-age-65 and a lifetime plan. The tables are based on the most recently available intercompany experience for individually underwritten medical expense policies, as reported in *TSA, 1972 Reports* and *1974 Reports*. They are designed with the specific intention of being an appropriate basis for the calculation of statutory reserves for such policies. These tables retain the slope of the claim costs contained in the *Reports*, except where this would produce reserves that are not felt to be sufficiently conservative for statutory valuation purposes.

This paper describes in detail the development of the values shown in the 1974 Medical Expense Tables. Included are discussions of the sources of the basic data used, the modifications of those data, the methods used to graduate the data, and the extensions of the data to high attained ages where no published intercompany data are available. For benefits such as cancer expense, for which there is a lack of published intercom-

pany experience, the statistics and techniques used to develop the values in the tables are described in detail.

The formulas used to calculate the commutation functions, net single premiums, net annual premiums, and midterminal reserve factors in the 1974 Medical Expense Tables are consistent with those used in the 1956 Intercompany Hospital and Surgical Tables and the 1964 Commissioners Disability Table. These formulas are shown in Appendix I of this paper.

Appendix II is comprised of tables that contain the net annual claim costs at all attained ages for all benefits included in the 1974 Medical Expense Tables.

Reasons for the Development of New Tables

The hospital and surgical tables recommended by Task Force 4 were published in 1956. As mentioned in the previous section, complete major medical tables were first published in 1965. Some of the morbidity factors that were used in these prior tables are still accurate, but others are out of date. The degree to which these tables depart from current experience is described in more detail in the descriptions and comparison tables for each benefit shown later in this paper. Some of the more important problems are listed below.

1. Through attained age 65, the frequencies of hospital confinement based on current intercompany experience are approximately the same as the corresponding frequencies from the 1956 Intercompany Hospital Table. However, current experience shows that these hospital frequency rates continue to increase rapidly after age 65. For male lives, current hospital frequency rates for individually underwritten lives exceed the 1956 Intercompany Hospital Table frequency rates by 50 percent after age 65.
2. The 1956 Intercompany Surgical Table claim costs assumed no further increases beyond attained age 65. The current experience for male lives indicates a steep increase throughout; there is no evidence of any leveling by attained age. For females the slope of current experience follows the slope of the 1956 Intercompany Surgical Tables through attained age 65, but the claim costs then begin to increase.
3. Current experience shows that the claim costs for surgical benefits are substantially higher than those shown in the 1956 Intercompany Surgical Table. (This is in addition to the considerations relating to the slope of these claim costs, described in item 2 above.)
4. The current claim costs for miscellaneous hospital benefits in excess of $100 are substantially greater than those shown in the 1956 Intercompany Hospital Table.
5. Current claim costs for major medical benefits without inside limits are many times greater than those indicated in the papers written by Mr.

Morton Miller and Mr. Charles Walker in the 1950s and are substantially greater than the claim costs used in the major medical tables published by Nelson and Warren, Inc., in 1965.

It is apparent that new tables reflecting current experience are needed to replace the existing valuation tables. More important, since in many cases the difference between recent morbidity and the morbidity assumed in the existing valuation tables is greatest at the higher attained ages, reserves based on recent morbidity generally are higher than corresponding reserves from the existing valuation tables, especially for lifetime plans.

It is believed that new tables that are properly constructed and widely used will be approved by state insurance departments and also will qualify with the Internal Revenue Service as a recognized basis of morbidity for federal income tax purposes.

Adjustments to Basic Tables

Many actuaries find that adjustments to basic tables are required because of the wide variety of benefits and limits provided by individual hospital and medical expense policies. Therefore, the 1974 Medical Expense Tables include several adjustment tables that can be used to modify the basic tables in order to value other benefits. These adjustment tables, by their very nature, are based less on published intercompany experience than are the basic values for such benefits as daily hospital benefits. It is expected that there might be a wide diversity of opinion among knowledgeable health insurance actuaries regarding the adjustment tables they would consider most appropriate.

In the construction of these adjustment tables for some benefits such as cancer benefits, it is essential to devise methods of reserving for a variety of benefit designs. The industry today is offering a wide variety of cancer plans with varying component benefits and inside limits. To deal with this diversity, a standard set of benefits is identified. Then a method is constructed whereby the benefits and reserves of a particular plan can be evaluated in terms of the corresponding values from the standard plan.

Certain adjustment tables should continue to be proper for a substantial period of time, but some will be subject to continuous change. For example, the 1974 Medical Expense Tables contain values for a $200 maximum miscellaneous hospital benefit. Also shown is a table of adjustment factors that can be used to convert the $200 maximum benefit values to values for other maximum amounts. The values in this adjustment table are based on what is considered to be the expected level of

hospital and medical charges experienced in 1977. The $200 maximum miscellaneous hospital benefit shows an average-size claim that is already almost $200, and therefore there can be very little increase due to the rising cost of provider charges. However, the costs of miscellaneous hospital benefits with maximum amounts such as $1,000 or $5,000 or with no maximum can increase significantly. Therefore, the values shown in the miscellaneous hospital expense benefit adjustment table will change over a period of time. This same property applies to the adjustment tables for major medical benefits.

Special Problems of Valuing Benefits with Increasing Costs

In this paper no attempt is made to give an exhaustive analysis of the difficulty of valuing benefits for which costs increase with the costs of the provider charges, such as unlimited major medical benefits. It has been suggested that one might build directly into a reserving system the assumption that claim costs will increase, not only with advancing age but also with the secular increases in charges that are likely to occur. This technique has not been used in the construction of the 1974 Medical Expense Tables. These considerations constitute a subject that deserves a paper of its own.

For major medical benefits the 1974 Medical Expense Tables contain claim costs that reflect levels of charges for the year 1972. In constructing these claim costs from intercompany data, experience prior to 1972 is increased by an annual trend factor of 12.2 percent to bring it forward to a 1972 level of charges. A second set of major medical claim costs is constructed by projecting these 1972 claim costs forward at the same 12.2 percent annual secular trend rate for a six-year period. These latter values are denoted in the 1974 Medical Expense Tables as claim costs for a 1978 projected level of charges for major medical policies. This technique of using a static rather than a periodically increasing level of charges for the valuation of major medical benefits is admittedly imperfect. However, the alternative methods are not without deficiencies; basically the valuation of major medical policies is a difficult task. The construction of the major medical values contained in the 1974 Medical Expense Tables is based on the proposition that the existence of tables that may be accurate on a static basis for the 1972 level of charges and the 1978 projected level of charges is a better alternative than having no published tables whatsoever.

Many medicare supplement policies are written in such a way that the increases in the medicare deductible are transmitted directly to the medicare supplement policy in the form of increased costs. These policies

often provide for benefits that change automatically with the changes in the medicare deductibles, with the company having the right to change premiums to be consistent with the change in benefits. This creates a problem when reserves are calculated and applied on an original issue age basis. If a policy is valued at inception on the basis of a number of benefit units then in force and using the net premiums consistent with such benefits, the policy could continue to be valued using the same unit reserve factors each year but with the value of a unit of benefits adjusted for the revised level of future benefits. Such a reserving procedure requires a transfer of surplus into reserves at the time of each benefit change in order to accommodate the higher level of benefits. This technique is not a sophisticated one and may seem unsatisfactory to some actuaries. However, the reserves that accumulate for this type of policy are not large, and, with the effect of terminations occurring at the upper ages, the aggregate financial effect of using this procedure does not appear to be too severe. If these policies were written on a guaranteed renewable basis but with premium changes by attained age, the problem would be minimized. If the original issue age basis is retained, it would be possible to calculate the present value of future benefits assuming an increase in benefits of 12 percent per year, for example, and assuming consistent periodic increases in premiums. This would produce a series of net premiums and reserves that would be more consistent with the values actually developed under the policy. On the other hand, it has been industry tradition to avoid anticipating benefits that are not specifically called for in the contract or premium increases that have not been specifically contemplated in the premium rate schedule. It is hoped that the discussions of this paper will deal with this question of proper reserving techniques for policies with automatic adjustments of benefits.

Construction of Values

For each morbidity element contained in the 1974 Medical Expense Tables, there are descriptions in the sections that follow of the source of the data used, the modifications of the data, their graduation, and the extension of the data to high attained ages. The net annual claim costs from the 1974 Medical Expense Tables are compared with the corresponding crude values from the source data and with the corresponding values from the 1956 Intercompany Hospital and Surgical Tables. For many benefits, comparisons are shown of net level annual premiums and two-year preliminary term midterminal reserves computed using the 1958 CSO Mortality Table and 3 percent interest. In addition, the adjustment tables referred to previously are described in more detail and their construction is explained.

II. HOSPITAL FREQUENCY RATES

The sources of hospital frequency rates used in the 1974 Medical Expense Tables are the crude frequencies of hospitalization for individually underwritten lives for a daily hospital benefit with a 90-day maximum benefit period and no deductible. These frequencies, displayed in *TSA, 1972 Reports*, page 170, Table 2, and *TSA, 1974 Reports*, page 70, Table 2, are based on the aggregate experience for all durations combined. In order to eliminate the effects of selection and to bring these frequencies to an ultimate level of experience (thus being consistent with statutory reserving principles), the frequencies are divided by ratios of aggregate experience for all durations to ultimate experience for durations 3 and later. These ratios of aggregate to ultimate experience are the ones for all attained ages combined that appear on pages 172 and 74 of the *1972* and *1974 Reports*, respectively. There is one exception: the ratio of 100 percent for females in the *1972 Reports* appeared to be illogical and was adjusted empirically to 98 percent.

The two sets of crude frequency rates, adjusted to reflect experience in durations 3 and later, are combined into one set of crude frequency rates by weighting the two sets by the respective amounts of daily hospital benefits in force on claims in the two reports ($15,092,739, or 68.2 percent, from the *1972 Reports*, and $7,027,787, or 31.8 percent, from the *1974 Reports*).

Shown in the accompanying tabulation is an example of the development of the combined crude hospital frequency rates for a male life at attained age 37 (assumed to be the central age of the age group 35–39).

Several methods of graduation of the combined crude hospital frequency rates were attempted. For male lives the method that gives a satisfactory combination of smoothness and fidelity to the crude data is to interpolate separately the crude frequency rates for every tenth

FREQUENCY OF HOSPITALIZATION
MALE, ATTAINED AGE 37

Source	Crude Frequency of Hospitalization for All Durations (1)	Ratio of Experience in All Durations to Experience in Durations 3 and Later (All Ages Combined) (2)	Crude Frequency of Hospitalization for Durations 3 and Later [(1)/(2)] (3)
TSA, 1972 Reports	.0824	.98	.0841
TSA, 1974 Reports	.0839	.88	.0953

Combined crude frequency rate for durations 3 and later

$$= (0.682) \times (0.0841) + (0.318) \times (0.0953) = 0.0877$$

attained age beginning at age 17 (17, 27, . . . , 77) and every tenth attained age beginning at age 22 (22, 32, . . . , 72). Both interpolations are performed by passing a different cubic polynomial through each pair of consecutive points and then fitting these curves together to produce one smooth, continuous curve. The curve between each pair of consecutive points is determined by the three points on each side of the interval of interpolation.[1] The results of these two interpolations are then averaged to produce final graduated frequency rates. The resulting frequency rates at attained ages below 22 are lowered empirically by requiring that the rate at attained age 17 be 125 percent of the rate at attained age 22.

For female lives within the attained-age ranges 17–27 and 47–57, the above graduation technique produces graduated frequency rates that maintain the decreasing pattern shown in the crude frequency rates. Even though these decreases occur in both the crude and the graduated female hospital frequency rates shown in the *1972* and *1974 Reports*, it was decided to modify these patterns in order to produce more conservative net premiums and reserves. A graphic graduation of the combined crude frequency rates was made, producing a smooth set of almost continuously increasing frequency rates. The resulting graduated frequency rates show a relatively poor fit to the crude data at the ages in question.

Hospital frequency rates above attained age 77 (the central age of the last age group for which data are shown in the *Reports*) are developed by the following formulas. If F_y is the hospital frequency rate at attained age y, then

$$F_y = F_{77}[1 + 0.03(y - 77)], \quad 77 < y \leq 87$$

$$= F_{87}[1 + 0.02(y - 87)], \quad 87 < y \leq 99.$$

By contrast, the hospital frequency rates in the 1956 Intercompany Hospital Table for all ages above age 80 were set equal to the frequency rate at age 80 (0.1756 for both male and female lives).

Shown in Table 1 is a comparison at selected attained ages of the various crude and graduated hospital frequency rates described above, along with similar rates from the 1956 Intercompany Hospital Table. The hospital frequency rates from the 1974 Medical Expense Tables are generally consistent with corresponding rates from the 1956 Intercompany Hospital Table below attained age 65 but are materially higher thereafter.

[1] The exact method employed is taken from a paper written by Hiroshi Akima for the Environmental Science Services Administration of the United States Department of Commerce, entitled "A Method of Smooth Curve Fitting" (ESSA Technical Report ERL 101-ITS 73, January, 1969).

III. AVERAGE PERIODS OF HOSPITALIZATION

The average periods of hospitalization used in constructing the 1974 Medical Expense Tables are developed by the same techniques used in developing the corresponding hospital frequency rates. Crude average periods of hospitalization are taken to be the average claim values for a daily hospital benefit with a 90-day maximum benefit period and no deductible, as shown in the *1972 Reports*, page 170, Table 2, and the *1974 Reports*, page 70, Table 2. These two sets of crude average periods of hospitalization, based on aggregate experience for all durations combined, are modified to an ultimate level of experience for durations 3 and later in the same manner as the hospital frequency rates are modified.

TABLE 1

COMPARISON OF HOSPITAL FREQUENCY RATES

Attained Age	Crude Frequencies from *TSA Reports*					Graduated Frequencies	
	All Durations		Durations 3 and Later				
	1972 Reports	*1974 Reports*	*1972 Reports*	*1974 Reports*	*1972* and *1974 Reports* Combined	1974 Medical Expense Tables	1956 Inter-company Hospital Table
	Male						
17	.0947	.1248	.0966	.1418	.1011	.0928	.0783
27	.0661	.0620	.0674	.0705	.0684	.0698	.0758
37	.0824	.0839	.0841	.0953	.0877	.0865	.0797
47	.1059	.1068	.1081	.1214	.1123	.1121	.1003
57	.1413	.1430	.1442	.1625	.1500	.1484	.1339
67	.2216	.2141	.2261	.2433	.2316	.2195	.1665
77	.3014	.2996	.3076	.3405	.3181	.3181	.1751
87	.....	.....	.....	.....	.....	.4135	.1756
	Female						
17	.1144	.1256	.1167	.1336	.1221	.1221	.0935
27	.0998	.1034	.1018	.1100	.1044	.1170	.1116
37	.1325	.1325	.1352	.1410	.1370	.1267	.1306
47	.1472	.1491	.1502	.1586	.1529	.1442	.1455
57	.1368	.1357	.1396	.1444	.1411	.1659	.1577
67	.1763	.1797	.1799	.1912	.1835	.1925	.1682
77	.2392	.2484	.2441	.2643	.2505	.2505	.1751
87	.....	.....	.....	.....	.....	.3257	.1756

AVERAGE PERIOD OF HOSPITALIZATION
MALE, ATTAINED AGE 37

Source	Crude Average Period of Hospitalization for All Durations Combined (Days) (1)	Ratio of Experience in All Durations to Experience in Durations 3 and Later (All Ages Combined) (2)	Crude Average Period of Hospitalization for Durations 3 and Later [(1)/(2)] (3)
TSA, 1972 Reports.....	7.00	0.96	7.29
TSA, 1974 Reports.....	7.15	0.97	7.37

Combined crude average for durations 3 and later

$$= (0.682) \times (7.29) + (0.318) \times (7.37) = 7.32 \text{ days}$$

The two sets of crude average periods of hospitalization, adjusted to reflect ultimate experience, are then combined into one set of crude average periods of hospitalization by weighting the two sets in the same manner as the hospital frequency rates are weighted (68.2 percent of the values based on the *1972 Reports* plus 31.8 percent of the values based on the *1974 Reports*).

Shown in the tabulation above is an example of the development of the crude average periods of hospitalization from the *1972 Reports* and the *1974 Reports* combined, for a male life at attained age 37.

The combined crude average periods of hospitalization are graduated by the same method used in graduating the combined crude hospital frequency rates for male lives, as described in the preceding section. Whereas the graduated hospital frequency rate for male lives at attained age 17 is lowered empirically, no such adjustment is made to the resulting graduated average periods of hospitalization.

Average periods of hospitalization above attained age 77 (the central age of the last age group for which data are shown in the *Reports*) are developed by the following formula. If AS_y is the average period of hospitalization at attained age y, then

$$AS_y = AS_{77}[1 + 0.01(y - 77)], \quad 77 < y \leq 99.$$

In the 1956 Intercompany Hospital Table the average period of hospitalization for all ages above attained age 80 was set equal to that at attained age 80 (26.2 days for both male and female lives).

Shown in Table 2 is a comparison at selected attained ages of the various crude and graduated average periods of hospitalization described above, along with similar values from the 1956 Intercompany Hospital Table. Table 2 shows that the average periods of hospitalization in the

1972 and *1974 Reports* and in the 1974 Medical Expense Tables are lower for both sexes at all attained ages than the corresponding periods in the 1956 Intercompany Hospital Table.

IV. DAILY HOSPITAL BENEFIT

The net annual claim costs for a $10 daily hospital benefit with a 90-day maximum benefit period that appear in Volume I of the 1974 Medical Expense Tables are computed as $10 times the hospital frequency rate described in Section II times the average period of hospitalization described in Section III. These products are computed for each attained age, so no further graduations are necessary in arriving at a full set of daily hospital benefit net annual claim costs.

TABLE 2

COMPARISON OF AVERAGE PERIODS OF HOSPITALIZATION (IN DAYS)
90-DAY MAXIMUM BENEFIT PERIOD DAILY HOSPITAL BENEFIT

Attained Age	Crude Values from *TSA Reports*					Graduated Values	
	All Durations		Durations 3 and Later				
	1972 Reports	*1974 Reports*	*1972 Reports*	*1974 Reports*	*1972* and *1974 Reports* Combined	1974 Medical Expense Tables	1956 Intercompany Hospital Table
	Male						
17	6.45	6.09	6.72	6.28	6.58	6.58	7.45
27	6.06	6.45	6.31	6.65	6.42	6.46	7.57
37	7.00	7.15	7.29	7.37	7.32	7.40	8.86
47	8.43	8.52	8.78	8.78	8.78	8.85	11.25
57	10.11	9.92	10.53	10.23	10.43	10.46	12.58
67	12.40	12.59	12.92	12.98	12.94	12.78	13.78
77	15.04	14.53	15.67	14.98	15.45	15.45	23.34
87	.....	.....	.....	.....	.....	17.00	26.20
	Female						
17	4.99	5.01	5.09	5.11	5.10	5.10	7.26
27	6.07	5.98	6.19	6.10	6.16	6.21	7.73
37	7.32	7.24	7.47	7.39	7.45	7.45	8.78
47	8.34	8.07	8.51	8.23	8.42	8.49	9.98
57	9.83	9.59	10.03	9.79	9.95	9.87	11.40
67	12.51	12.29	12.77	12.54	12.70	12.43	13.67
77	15.16	14.97	15.47	15.28	15.41	15.41	23.34
87	.....	.....	.....	.....	.....	16.95	26.20

The 1974 Medical Expense Tables contain a table of adjustment factors that can be used to modify the net annual claim costs, net annual premiums, and reserve factors applicable to a 90-day maximum benefit period to obtain values for other maximum benefit periods. These adjustment factors are found in Table C of the paper "Reserves for Individual Hospital and Surgical Expense Insurance" by Edwin L. Bartleson and James J. Olsen (*TSA*, IX, 339).

Shown in Table 3 is a comparison at selected attained ages of the crude net annual claim costs for a $10 daily hospital benefit from the *1972* and *1974 Reports* and the corresponding graduated values from the 1956 Intercompany Hospital Table and from the 1974 Medical Expense Tables. The *Reports* data are derived from Table 3 on page 171 of the *1972 Reports* and Table 3 on page 73 of the *1974 Reports*, adjusted to

TABLE 3

COMPARISON OF NET ANNUAL CLAIM COSTS
$10 DAILY HOSPITAL BENEFIT—
90-DAY MAXIMUM BENEFIT PERIOD

Attained Age	Crude Values, Durations 3 and Later		Graduated Values	
	1972 Reports	*1974 Reports*	1974 Medical Expense Tables	1956 Intercompany Hospital Table
	Male			
17	$ 6.50	$ 8.94	$ 6.11	$ 5.83
27	4.27	4.71	4.51	5.74
37	6.14	7.06	6.40	7.06
47	9.50	10.71	9.92	11.28
57	15.20	16.69	15.52	16.84
67	29.23	31.71	28.05	22.95
77	48.22	51.21	49.15	40.87
87	.....	.....	70.30	46.00
	Female			
17	$ 5.95	$ 6.84	$ 6.23	$ 6.79
27	6.31	6.72	7.27	8.63
37	10.10	10.42	9.44	11.47
47	12.79	13.08	12.24	14.52
57	14.01	14.14	16.37	17.98
67	22.98	24.00	23.93	22.99
77	37.77	40.41	38.60	40.87
87	.....	.....	55.21	46.00

reflect the experience of durations 3 and later using the relationships shown on pages 172 and 74 of the respective *Reports*. The data in Table 3 of this paper demonstrate that the net annual claim costs from the *Reports* and from the 1974 Medical Expense Tables are lower than those from the 1956 Intercompany Hospital Table through about attained ages 60 for males and 65 for females, and are higher thereafter. For both male and female lives the slope of these costs in the 1974 Medical Expense Tables is steeper than the slope of the corresponding costs in the 1956 Intercompany Hospital Table.

Table 4 contains a similar comparison of net level annual premiums for a $10 daily hospital benefit from the 1974 Medical Expense Tables and from the 1956 Intercompany Hospital Table. The net premiums are shown for both a term-to-age-65 and a lifetime plan. For a term-to-age-65 plan, Table 4 shows that for all ages and both sexes the net premiums from the 1974 Medical Expense Tables are lower than the net premiums based on the 1956 Intercompany Hospital Table. For a lifetime plan, the net premiums from the 1974 Medical Expense Tables are lower through about issue ages 30 for male lives and 60 for female lives, and are higher thereafter.

Table 5 contains a comparison at selected issue ages and policy years of two-year preliminary term midterminal reserves for a $10 daily hospital benefit from the 1974 Medical Expense Tables and from the 1956 Intercompany Hospital Table. The comparison is made both for a term-to-age-65 and for a lifetime plan. For a term-to-age-65 plan the reserves from the 1974 Medical Expense Tables are generally larger than corresponding reserves from the 1956 Intercompany Hospital Table, although not larger at every issue age and duration. For a lifetime plan the reserves from the 1974 Medical Expense Tables are almost always larger than corresponding reserves from the 1956 Intercompany Hospital Table.

It can be said with reasonable certainty that aggregate reserves for a daily hospital benefit based on the 1974 Medical Expense Tables usually will be larger than aggregate reserves based on the 1956 Intercompany Hospital Table.

V. MISCELLANEOUS HOSPITAL EXPENSE BENEFIT

The development of the net annual claim costs and associated values contained in the 1974 Medical Expense Tables for a $200 maximum miscellaneous hospital benefit begins with an examination of the crude average claim values shown in Table 5 on page 175 of the *1972 Reports* and Table 5 on page 76 of the *1974 Reports*. These average claim values are developed from the experience of the periods 1968–70 and 1971–72,

respectively. Since these average claims are subject to the inflationary increase in costs for nonscheduled benefits that the industry has experienced, the values shown in the *Reports* are brought forward with trend factors to be consistent with an assumed level of charges as of January 1, 1977. The trend factors used are based on values shown in

TABLE 4

COMPARISON OF NET LEVEL ANNUAL PREMIUMS $10 DAILY HOSPITAL BENEFIT— 90-DAY MAXIMUM BENEFIT PERIOD 1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

Issue Age	1956 Intercompany Hospital Table	1974 Medical Expense Tables
	Term-to-Age-65 Plan	
Male:		
25....	$ 9.18	$ 8.24
35....	11.35	10.44
45....	14.41	13.38
55....	17.66	17.39
Female:		
25....	12.30	10.54
35....	14.32	12.42
45....	16.35	14.62
55....	18.47	17.37
	Lifetime Plan	
Male:		
25....	$11.07	$10.90
35....	13.94	14.23
45....	17.95	18.93
55....	22.78	25.87
65....	29.77	36.62
75....	39.76	50.79
85....	40.80	63.64
Female:		
25....	13.89	12.33
35....	16.49	14.91
45....	19.44	18.20
55....	23.25	22.79
65....	29.29	29.64
75....	39.76	39.90
85....	40.80	49.99

TABLE 5—COMPARISON OF TWO-YEAR PRELIMINARY TERM MIDTERMINAL RESERVE FACTORS
$10 DAILY HOSPITAL BENEFIT—90-DAY MAXIMUM BENEFIT PERIOD
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

Issue Age	Policy Year 4		Policy Year 8		Policy Year 13		Policy Year 18		Policy Year 25		Policy Year 35	
	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables
	Term-to-Age-65 Plan											
Male:												
25...	$ 6.06	$ 6.48	$23.40	$24.03	$44.92	$ 44.54	$ 62.73	$ 61.27	$ 74.13	$ 74.29	$ 46.89	$ 55.24
35...	7.62	7.18	26.00	24.70	42.60	41.79	48.66	51.46	35.20	43.59	.....	.....
45...	6.00	6.59	17.58	21.09	21.67	29.72	11.76	18.32	.....	.....	.....	.....
55...	2.63	4.74	4.04	7.88	.....	.....	.....	.....	.....	.....	.....	.....
Female:												
25...	6.44	5.76	22.09	20.46	37.82	36.34	48.48	48.38	53.36	56.75	33.40	39.36
35...	5.24	5.42	17.20	18.43	27.28	30.79	31.35	37.04	23.43	29.82	.....	.....
45...	3.78	4.69	11.37	14.63	14.59	19.79	8.32	11.75	.....	.....	.....	.....
55...	1.94	2.93	3.16	4.77	.....	.....	.....	.....	.....	.....	.....	.....
	Lifetime Plan											
Male:												
25...	$ 9.21	$10.94	$35.68	$41.45	$70.44	$ 80.71	$103.98	$119.70	$143.13	$172.18	$177.60	$240.67
35...	11.93	13.56	42.93	49.70	77.98	94.18	106.93	137.55	137.40	194.57	170.67	248.27
45...	11.96	16.06	41.22	58.63	72.49	110.39	98.90	156.70	133.01	203.03	133.52	212.38
55...	11.54	19.52	40.40	68.17	73.98	118.51	106.39	154.23	104.39	168.28	153.61	140.12
Female:												
25...	9.08	8.75	32.41	32.13	59.21	60.55	83.06	87.49	111.33	122,27	143.22	163.47
35...	8.86	9.60	31.40	34.81	57.10	65.13	80.27	93.47	109.19	128.78	149.33	164.05
45...	9.04	10.80	32.23	38.81	59.38	71.75	85.19	100.88	121.79	132.72	126.28	148.19
55...	10.37	12.37	37.52	43.25	70.93	76.53	103.85	104.11	102.54	119.49	52.51	102.50

the *1974 Reports*, page 86, Table 14. This table shows the annual rates of increase in average claim occurring over the previously mentioned experience periods, separately for various maximum miscellaneous benefits and separately by sex. For a $200 maximum benefit, Table 14 shows that the annual rate of increase in average claim for male lives was 5.2 percent for the period 1968–70 and 4.2 percent for the period 1971–72. Annual rates of increase in average claim after 1972 are projected from these latter values to be 3.2 percent for the period 1973–74 and 2.2 percent for the period 1975–76. Using these annual rates of increase, the average claims from the *1972 Reports* (1968–70 experience) and from the *1974 Reports* (1971–72 experience) are increased to a projected January 1, 1977, level of average claim by multiplying by factors of 1.2863 ($=1.042^2 \times 1.032^2 \times 1.022^3$) and 1.1369 ($=1.032^2 \times 1.022^3$), respectively. A similar process is used for female lives.

Another adjustment made to the crude average claim values shown in the *Reports* is to adjust them from an aggregate level of experience for all durations combined to an ultimate level of experience for durations 3 and later. Because ratios of ultimate to aggregate experience are not shown for miscellaneous hospital benefits, the ratios of average claim per $1 of daily benefit (average hospital stay) are used. These ratios are shown in the *1972 Reports*, page 172, and the *1974 Reports*, page 74.

The two sets of crude average claim values, projected to January 1, 1977, and adjusted to an ultimate experience basis, are combined into one set of crude average claim values by a weighting process by pivotal age, using as weights the numbers of claims shown in Table 5 of each *Reports* number. An example of this weighting process is shown below for a male life at attained age 32.

This weighting process yields one set of crude average claim values at pivotal attained ages. These pivotal average claim values then are multiplied by the corresponding hospital frequency rates as described in

$200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT
MALE, ATTAINED AGE 32

Source	Crude Average Claim, Projected to January 1, 1977, Durations 3 and Later	Number of Claims
TSA, 1972 Reports.....	$174.43	2,950
TSA, 1974 Reports.....	177.13	1,373

Combined crude average claim
$= [(\$174.43) \times (2{,}950) + (\$177.13) \times (1{,}373)]/(2{,}950 + 1{,}373)$
$= \$175.29$

Section II, to produce the net annual claim costs for a $200 maximum miscellaneous hospital benefit. The empirically adjusted hospital frequency rate for male lives at attained age 17 is used in producing the pivotal net annual claim costs at that age. The claim costs then are graduated using the same method described in Section II for male lives.

Miscellaneous hospital benefit net annual claim costs beyond age 77 are obtained by multiplying the hospital frequency rates at these ages by the average claim values for male and female lives at attained age 77, which are $198.35 and $195.99, respectively.

Table 6 contains sample values of the crude unprojected and crude projected $200 maximum miscellaneous hospital benefit average claims

TABLE 6

COMPARISON OF AVERAGE CLAIM AMOUNTS
$200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT

Attained Age	Crude Values from *TSA Reports*					Graduated Values	
	All Durations Unprojected		Durations 3 and Later—Projected to January 1, 1977				
	1972 Reports	*1974 Reports*	*1972 Reports*	*1974 Reports*	*1972* and *1974 Reports* Combined	1974 Medical Expense Tables	1956 Inter-company Hospital Table
	Male						
17	$114.30	$149.47	$146.97	$175.19	$155.68	$155.68	$ 85.30
27	132.75	152.19	170.69	178.38	172.86	171.24	93.19
37	142.23	156.26	182.88	183.15	182.97	183.49	104.47
47	150.29	166.86	193.24	195.58	193.98	194.98	115.74
57	154.90	169.89	199.17	199.13	199.16	199.35	127.02
67	155.94	169.88	200.00	199.12	199.70	199.85	138.29
77	154.00	169.78	198.01	199.00	198.35	198.35	149.57
87	.....	.....	.....	.....	.....	198.35	152.95
	Female						
17	$113.53	$148.05	$146.24	$175.31	$151.13	$151.13	$ 85.30
27	138.23	158.74	178.05	187.96	181.26	180.66	93.19
37	151.89	166.30	195.65	196.92	196.04	195.91	104.47
47	156.21	170.15	200.00	200.00	200.00	199.81	115.74
57	153.38	169.31	197.57	200.00	198.40	198.78	127.02
67	152.52	166.27	196.46	196.88	196.60	197.56	138.29
77	150.89	167.66	194.36	198.53	195.99	195.99	149.57
87	.....	.....	.....	.....	.....	195.99	152.95

described above, along with the corresponding values from the 1974 Medical Expense Tables and from the 1956 Intercompany Hospital Table. (The 1956 Intercompany Hospital Table values are developed by using the procedure shown on the bottom half of p. 338 of *TSA*, Vol. IX.)

Shown in Table 7 is a comparison at selected ages of net annual claim costs and net level annual premiums for a $200 maximum miscellaneous hospital benefit from the 1974 Medical Expense Tables and from the 1956 Intercompany Hospital Table. Table 8 contains a similar comparison of two-year preliminary term midterminal reserves. From these comparisons it can be seen that the miscellaneous hospital expense benefit values in the 1956 Intercompany Hospital Table are inadequate.

TABLE 7

COMPARISON OF NET ANNUAL CLAIM COSTS AND NET LEVEL ANNUAL PREMIUMS
$200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT

Attained Age	Net Annual Claim Costs		Issue Age	Net Level Annual Premiums 1958 CSO Mortality Table, 3% Interest			
				Term-to-Age-65 Plan		Lifetime Plan	
	1956 Intercompany Hospital Table	1974 Medical Expense Tables		1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables
	Male			Male			
25	$ 7.00	$11.85	25	$10.08	$18.29	$11.32	$21.35
35	7.87	14.80	35	11.97	21.99	13.62	26.17
45	10.83	20.60	45	14.63	26.35	16.71	32.21
55	15.66	27.65	55	17.98	31.57	20.35	40.10
65	22.08	40.58	65	.....	.....	23.35	50.90
75	25.69	59.05	75	.....	.....	24.59	63.34
85	26.86	78.23	85	.....	.....	23.82	73.68
	Female			Female			
25	$ 9.74	$20.59	25	$14.30	$25.64	$15.16	$27.11
35	12.99	23.98	35	16.43	28.24	17.45	30.14
45	16.21	28.02	45	18.40	30.75	19.61	33.28
55	19.39	32.09	55	20.20	33.19	21.64	36.80
65	22.60	36.92	65	.....	.....	23.46	41.37
75	25.69	45.91	75	.....	.....	24.59	49.28
85	26.86	60.87	85	.....	.....	23.82	57.33

TABLE 8—COMPARISON OF TWO-YEAR PRELIMINARY TERM MIDTERMINAL RESERVE FACTORS
$200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

ISSUE AGE	POLICY YEAR 4		POLICY YEAR 8		POLICY YEAR 13		POLICY YEAR 18		POLICY YEAR 25		POLICY YEAR 35	
	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables
	Term-to-Age-65 Plan											
Male:												
25...	$5.36	$11.12	$20.40	$40.57	$38.92	$ 73.04	$54.24	$ 97.00	$ 65.97	$111.60	$ 45.16	$ 76.68
35...	6.53	11.02	22.37	35.82	37.71	60.06	45.41	71.42	35.00	57.52	.....	.....
45...	5.83	8.83	17.99	27.61	23.43	37.74	12.55	22.48	.....	.....	.....	.....
55...	2.97	5.69	4.24	9.19	.....	.....	.....	.....	.....	.....	.....	.....
Female:												
25...	6.88	8.19	23.27	28.50	39.08	48.71	49.09	61.57	52.30	66.33	30.44	40.03
35...	5.18	6.57	16.70	21.22	25.90	33.20	28.73	37.46	20.12	27.19	.....	.....
45...	3.35	4.41	9.73	13.13	11.82	16.51	6.27	9.03	.....	.....	.....	.....
55...	1.36	2.06	2.06	3.17	.....	.....	.....	.....	.....	.....	.....	.....
	Lifetime Plan											
Male:												
25...	$7.43	$16.21	$28.47	$60.46	$55.66	$114.33	$81.29	$163.69	$111.27	$223.03	$130.98	$288.33
35...	9.24	18.00	32.99	64.19	59.97	117.42	82.01	165.68	99.18	222.80	89.15	261.32
45...	9.24	18.75	31.48	66.93	52.43	122.21	62.30	167.39	60.19	204.72	41.23	201.48
55...	6.74	20.36	19.59	69.05	26.54	115.19	26.65	144.38	19.96	152.50	6.59	119.02
Female:												
25...	8.27	10.62	28.70	37.97	50.34	68.37	67.29	93.32	82.78	119.53	88.18	140.82
35...	6.83	9.71	23.16	33.51	39.44	58.97	50.97	79.80	59.12	101.43	55.90	121.40
45...	5.32	8.67	17.53	30.00	28.59	52.76	35.04	71.22	36.73	92.85	26.08	111.57
55...	3.74	8.30	11.75	28.63	17.65	51.17	19.12	73.78	14.48	90.35	3.31	75.73

For all attained ages and both sexes the values from the 1974 Medical Expense Tables are uniformly and materially higher than the values from the 1956 Intercompany Hospital Table.

The 1974 Medical Expense Tables contain a table of adjustment factors that can be used to modify the values for a $200 maximum miscellaneous hospital benefit for other maximum benefit amounts. This table is based on data shown in "Sample of Group Hospital and Surgical Expense Insurance," *TSA, 1974 Reports*, page 205, Table 7 (combined for male and female employees). These miscellaneous hospital expense data are based on claims incurred during 1970, 1971, and 1972, with an assumed midpoint of July 1, 1971. In order to bring these costs forward to be consistent with a level of charges for January 1, 1977, it is assumed that claims will be 80 percent higher than claims incurred during the period 1970–72. The application of this assumption results in a projected average claim for each of a series of maximum benefits, such as $191 for a $200 maximum benefit and $516 for a $2,000 maximum benefit. For each maximum benefit, these projections are used to determine ratios of average claims to the average claim for a $200 maximum. An alternative method for determining these ratios is to use a published continuance table of hospital stays for male employees covered under group policies. This assumes that the average miscellaneous hospital charge for a one-day hospital stay is $125, for a two-day stay is $225, and so on, with diminishing increases in the average charge as the hospital stay becomes longer. Ratios determined in this manner are consistent with those developed from the "Sample of Group Hospital and Surgical Expense Insurance" data, as projected to January 1, 1977. The final adjustment factors, which are derived from a combination of these approaches, are shown in the following table:

MISCELLANEOUS HOSPITAL EXPENSE BENEFIT

FACTORS TO ADJUST $200 MAXIMUM BENEFIT VALUES TO CORRESPONDING VALUES FOR OTHER MAXIMUMS

(January 1, 1977, Level of Charges)

Maximum	Factor	Maximum	Factor
$200	1.00	$ 750	2.40
300	1.40	1,000	2.60
400	1.75	2,000	2.70
500	2.00	5,000	2.75

As mentioned in the Introduction, these ratios are subject to change, since the $200 maximum benefit costs have an average claim amount of $191 as of January 1, 1977, and therefore cannot experience any substantial further secular increases. However, the average benefit for a large maximum benefit such as $2,000 is still well below the maximum value and will increase as provider charges increase. Therefore, this adjustment table (and tables of a similar nature) should be updated every two or three years.

VI. SURGICAL EXPENSE BENEFIT

The net annual claim costs and related values shown in the 1974 Medical Expense Tables for a $100 maximum surgical benefit are based on the crude net annual claim costs shown in the *1972 Reports*, page 195, Table 15, and the *1974 Reports*, page 88, Table 15. All the data that underlie this crude experience have been adjusted or standardized to a 1957 California Relative Value Schedule (CRVS) basis, using the procedure shown in the *1963 Reports*, page 153, Table 14.

Like the other benefits discussed previously, these crude net annual claim costs are based on the aggregate experience for all durations combined. These costs are adjusted to reflect the experience of durations 3 and later by using the ratios of aggregate to ultimate experience shown in the *1972 Reports*, page 186, and the *1974 Reports*, page 89. The use of similar ratios to adjust the hospital frequency rates to an ultimate experience basis is described in Section II of this paper.

The resulting two sets of crude net annual claim costs are combined by weighting each set by the respective aggregate amounts of claims underlying the set ($63,000,000, or 60.3 percent, from the *1972 Reports*, and $41,500,000, or 39.7 percent, from the *1974 Reports*).

In order to develop values based on the same surgical schedule as the schedule that underlies the 1956 Intercompany Surgical Table values, the combined crude net annual claim costs at pivotal ages are adjusted from a $100, 1957 CRVS basis to a $100, 1956 Intercompany Surgical Schedule basis. This adjustment is made by applying to the 1957 CRVS pivotal claim costs an interpolation of the ratios of claim costs between the 1956 Intercompany Schedule and the 1957 CRVS, as developed in the *1963 Reports*, page 153, Table 14. These ratios range from 1.30 at attained age 17 to 1.13 at attained ages 72 and over for male lives, and from 1.27 at attained age 17 to 1.21 at attained ages 72 and over for female lives.

The male net annual claim cost at age 17 has been lowered empirically to 125 percent of the claim cost at attained age 22.

The final pivotal claim costs are graduated by the same method used to graduate the hospital frequency rates for male lives, as described in Section II of this paper.

Claim costs beyond attained age 77 are developed by extending the respective male and female claim costs at attained age 77, using the following formula, where S_y is the net annual claim cost at attained age y:

$$S_y = S_{77}[1 + 0.03(y - 77)], \quad 77 < y \leq 99.$$

These extended claim costs at the upper attained ages may be contrasted with the corresponding claim costs at the upper ages from the 1956 Intercompany Surgical Table, where the claim cost for attained ages 65 and above for both male and female lives is $3.33.

Table 9 gives a comparison at selected attained ages of these various crude and graduated claim costs for a $100 maximum standard surgical schedule benefit, along with similar claim costs from the 1956 Intercompany Surgical Table. It can be seen from this table that the 1974 Medical Expense Table claim costs are higher than the 1956 Intercompany Surgical Table claim costs, except at the very young ages. More noteworthy is the fact that the 1974 Medical Expense Table claim costs exhibit a much steeper slope than the claim costs from the 1956 Intercompany Surgical Table.

Shown in Table 10 is a comparison of $100 maximum surgical benefit net level annual premiums between the 1974 Medical Expense Tables and the 1956 Intercompany Surgical Table. The premiums are shown on both a term-to-age-65 plan and a lifetime plan basis. Table 10 shows that net premiums based on the 1974 Medical Expense Tables are higher in all cases than corresponding premiums from the 1956 Intercompany Surgical Table.

Table 11 shows a comparison at selected issue ages and policy years of two-year preliminary term midterminal reserve factors from the 1974 Medical Expense Tables and the 1956 Intercompany Surgical Table, for both a term-to-age-65 and a lifetime plan. Because of the decreasing nature of surgical costs for females between about ages 45 and 65, some of the female reserve factors from both tables are negative. In all but a few cases, reserves based on the 1974 Medical Expense Tables are higher than the corresponding reserves from the 1956 Intercompany Surgical Table. It seems apparent that any group of surgical benefits in force will have higher reserves when valued on the 1974 Medical Expense Tables than when valued on the 1956 Intercompany Surgical Table.

It is important to remember that the surgical claim costs, net pre-

miums, and reserve factors from both the 1974 Medical Expense Tables and the 1956 Intercompany Surgical Table are based on a standard schedule. Before any of these values are used to determine reserves for the surgical benefits of a specific policy, the surgical schedule of that policy should be evaluated in terms of the standard surgical schedule. A description of how such an evaluation might be done is shown in *TSA*, IX, 341–42. An evaluation by age group and sex is more accurate. Table 14 in the *1963 Reports*, pages 153–54, illustrates some surgical weighting factors by age group and sex, together with an example of how this latter type of evaluation can be performed.

TABLE 9

COMPARISON OF NET ANNUAL CLAIM COSTS
$100 MAXIMUM SURGICAL BENEFIT
STANDARD (1956 INTERCOMPANY) SURGICAL SCHEDULE

Attained Age	Crude Values from *TSA Reports*					Graduated Values	
	All Durations		Durations 3 and Later				
	1972 Reports	*1974 Reports*	*1972 Reports*	*1974 Reports*	*1972* and *1974 Reports* Combined	1974 Medical Expense Tables	1956 Intercompany Surgical Table
	Male						
17	$2.43	$2.85	$2.48	$3.00	$2.59	$2.08	$1.80
27	1.42	1.59	1.44	1.66	1.53	1.57	1.71
37	1.81	2.12	1.85	2.24	2.00	1.98	1.78
47	2.51	2.63	2.57	2.77	2.65	2.61	2.20
57	3.53	3.96	3.61	4.17	3.84	3.90	2.97
67	5.76	5.64	5.88	5.93	5.90	5.81	3.33
77	7.01	7.27	7.15	7.65	7.36	7.36	3.33
87	.....	.....	.....	.....	.....	9.57	3.33
	Female						
17	$2.13	$2.63	$2.16	$2.71	$2.27	$2.27	$2.20
27	2.29	2.79	2.31	2.88	2.54	2.60	3.08
37	3.70	4.00	3.73	4.13	3.89	3.96	3.87
47	4.26	4.70	4.30	4.85	4.51	4.45	4.01
57	3.57	3.99	3.61	4.12	3.81	3.84	3.50
67	4.34	4.56	4.39	4.71	4.51	4.39	3.33
77	5.31	5.84	5.36	6.03	5.63	5.63	3.33
87	.....	.....	.....	.....	.....	7.32	3.33

TABLE 10

COMPARISON OF NET LEVEL ANNUAL PREMIUMS $100 MAXIMUM SURGICAL BENEFIT—STANDARD (1956 INTERCOMPANY) SURGICAL SCHEDULE 1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

Issue Age	1956 Intercompany Hospital Table	1974 Medical Expense Tables
	Term-to-Age-65 Plan	
Male:		
25	$2.03	$2.32
35	2.24	2.77
45	2.59	3.35
55	3.01	4.20
Female:		
25	3.55	3.58
35	3.76	4.05
45	3.63	4.03
55	3.37	3.82
	Lifetime Plan	
Male:		
25	$2.13	$2.70
35	2.37	3.29
45	2.73	4.07
55	3.08	5.15
65	3.17	6.36
75	3.10	7.42
85	2.95	8.63
Female:		
25	3.52	3.70
35	3.67	4.16
45	3.52	4.22
55	3.28	4.26
65	3.17	4.82
75	3.10	5.67
85	2.95	6.60

TABLE 11—COMPARISON OF TWO-YEAR PRELIMINARY TERM MIDTERMINAL RESERVE FACTORS
$100 MAXIMUM SURGICAL BENEFIT—STANDARD (1956 INTERCOMPANY) SURGICAL SCHEDULE
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

Issue Age	Policy Year 4		Policy Year 8		Policy Year 13		Policy Year 18		Policy Year 25		Policy Year 35	
	1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables
	Term-to-Age-65 Plan											
Male:												
25...	$0.59	$1.32	$2.25	$4.85	$4.44	$ 8.91	$6.63	$12.19	$ 8.50	$15.09	$ 5.30	$11.06
35...	0.84	1.42	3.05	4.87	5.24	8.43	6.08	10.67	4.18	8.72	.....	.....
45...	0.79	1.43	2.27	4.56	2.60	6.13	1.23	3.45	.....	.....	.....	.....
55...	0.24	0.84	0.29	1.28	.....	.....	.....	.....	.....	.....	.....	.....
Female:												
25...	0.87	1.72	2.28	5.26	2.58	7.00	1.16	5.93	− 1.45	2.31	− 1.52	0.79
35...	− 0.10	0.24	− 1.08	− 0.06	− 2.74	− 1.61	− 3.43	− 2.48	− 2.25	− 1.12	.....	.....
45...	− 0.55	− 0.59	− 1.43	− 1.40	− 1.50	− 0.96	− 0.70	− 0.10	.....	.....	.....	.....
55...	0.11	0.11	− 0.16	− 0.27	.....	.....	.....	.....	.....	.....	.....	.....
	Lifetime Plan											
Male:												
25...	$0.76	$1.96	$2.94	$7.32	$5.91	$14.03	$9.01	$20.46	$12.39	$28.93	$12.70	$37.29
35...	1.06	2.29	3.90	8.27	7.01	15.56	9.02	22.38	9.34	29.26	6.39	30.76
45...	0.99	2.63	3.09	9.34	4.38	16.38	4.26	21.04	2.98	23.29	1.34	21.58
55...	0.32	2.44	0.62	7.78	0.33	12.03	− 0.03	14.00	− 0.47	14.18	− 0.95	12.55
Female:												
25...	0.79	1.90	2.00	5.96	2.05	8.45	0.28	8.27	− 2.99	6.23	− 4.45	8.21
35...	− 0.25	− 0.43	− 1.67	0.65	− 3.95	− 0.12	− 5.38	− 0.03	− 5.73	3.19	− 4.74	8.83
45...	− 0.72	− 0.24	− 2.09	0	− 2.89	2.05	− 3.11	5.07	− 2.85	8.85	− 2.43	11.05
55...	− 0.25	0.92	− 0.72	3.58	− 0.95	6.69	− 1.08	8.87	− 1.24	10.30	− 1.41	8.91

VII. MATERNITY BENEFIT

The net annual claim costs and associated values for a $100 maternity benefit that appear in the 1974 Medical Expense Tables are based on the data shown in the *1972 Reports*, page 192, Table 20, and the *1974 Reports*, page 96, Table 20. These tables show both numbers of maternity claims and maternity frequency rates separately by attained-age group and by duration. Separate data are given for durations 1, 2, 3, 4, and 5 and later and for all durations combined. As noted previously, the experience from the *Reports* used in constructing the 1974 Medical Expense Tables is the experience for durations 3 and later. In order to make the maternity values consistent with this treatment, maternity frequency rates for durations 3 and later are developed from the experience for durations 3, 4, and 5 and later as shown in Table 20 of the two *Reports* numbers. These three separate groups of frequency rates are combined into one set of frequency rates for durations 3 and later by dividing the total number of claims by the total number of exposures underlying these claims. An example of this process for attained age 27 is shown below.

DEVELOPMENT OF MATERNITY FREQUENCIES FOR DURATIONS 3 AND LATER, ATTAINED AGE 27

Source	Duration 3			Duration 4		
	No. of Claims (1)	Claim Frequency (2)	Lives Exposed [(1)/(2)] (3)	No. of Claims (4)	Claim Frequency (5)	Lives Exposed [(4)/(5)] (6)
TSA, 1972 Reports	3,842	.229	16,777	3,202	.225	14,231
TSA, 1974 Reports	2,076	.212	9,792	1,653	.205	8,063

Source	Durations 5 and Later			Durations 3 and Later		
	No. of Claims (7)	Claim Frequency (8)	Lives Exposed [(7)/(8)] (9)	No. of Claims [(1)+(4)+(7)] (10)	Lives Exposed [(3)+(6)+(9)] (11)	Claim Frequency [(10)/(11)] (12)
TSA, 1972 Reports	6,566	.164	40,037	13,610	71,045	.192
TSA, 1974 Reports	3,854	.148	26,041	7,583	43,896	.173

This process yields two sets of maternity frequency rates for the pivotal ages 22, 27, . . . , 47, representing experience in duration 3 and later from the *1972* and *1974 Reports*. These two sets of frequency rates are combined into one set by a weighting process that uses as weights the aggregate number of maternity claims from each of the two experience periods (61,260 claims, or 64.6 percent, from the *1972 Reports*, and 33,608, or 35.4 percent, from the *1974 Reports*).

The resulting combined maternity frequency rates at pivotal ages are graduated by using the curve-fitting interpolation technique described in Section II of this paper.

Shown in Table 12 are the various sets of maternity frequency rates

TABLE 12

COMPARISON OF MATERNITY FREQUENCY RATES AND NET LEVEL ANNUAL PREMIUMS

Attained Age	Maternity Frequency Rates			
	Crude Values from *TSA Reports*, Durations 3 and Later		Graduated Values	
	1972 Reports	*1974 Reports*	1974 Medical Expense Tables	1956 Intercompany Hospital Table
22.....	.278	.259	.271	.285
27.....	.192	.173	.185	.196
32.....	.093	.080	.088	.117
37.....	.040	.033	.038	.060
42.....	.010	.009	.010	.016
47.....	.001	.001	.000	.000

Issue Age	Net Level Annual Premiums—$100 Maternity Benefit 1958 CSO Mortality Table, 3% Interest			
	Term-to-Age-65 Plan		Lifetime Plan	
	1974 Medical Expense Tables	1956 Intercompany Hospital Table	1974 Medical Expense Tables	1956 Intercompany Hospital Table
20.....	$10.22	$11.45	$9.44	$10.57
25.....	6.17	7.31	5.59	6.63
30.....	2.97	4.11	2.63	3.63
35.....	1.20	1.88	1.03	1.61
40.....	0.32	0.52	0.26	0.43

referred to above, along with the corresponding rates from the 1956 Intercompany Hospital Table. The rates from the 1974 Medical Expense Tables generally are lower than those in the 1956 table.

Table 12 also contains a comparison of net level annual premiums for a $100 maternity expense benefit from the 1974 Medical Expense Tables and the 1956 Intercompany Hospital Table. For the 1974 Medical Expense Tables the net annual claim costs used in determining these net premiums are taken as $100 times the maternity frequency rates developed as indicated above. The net premiums in Table 12 are shown on both a term-to-age-65 and a lifetime basis. In all cases, net premiums from the 1974 Medical Expense Tables are lower than the corresponding net premiums from the 1956 Intercompany Hospital Table.

Table 13 gives a comparison, for selected issue ages and durations, of two-year preliminary term midterminal reserve factors for a $100 maternity expense benefit based on the 1974 Medical Expense Tables and the 1956 Intercompany Hospital Table. Because of the decreasing nature of maternity benefit costs, all the reserves shown are negative. In almost all cases, the reserves from the 1974 Medical Expense Tables are higher (smaller negative numbers) than the corresponding reserves from the 1956 Intercompany Hospital Table, for both a term-to-age-65 plan and a lifetime plan.

VIII. MAJOR MEDICAL EXPENSE BENEFIT

The major medical expense benefit values in the 1974 Medical Expense Tables are taken from the data shown in the *1972 Reports*, pages 196–97, Table 21, and the *1974 Reports*, pages 98–99, Table 21. The data in these tables cover the respective experience periods 1968–70 and 1971–72 and are based on the experience of durations 3 and later. This experience is taken from major medical plans with a $500 fixed deductible, 75 percent coinsurance, no inside limits as to hospital room and board benefits or surgical benefits, and maximum benefit amounts of either $5,000, $7,500, or $10,000. These data shown in the *Reports* are adjusted to be applicable to a major medical plan with a $500 fixed deductible, 80 percent coinsurance, no inside limits, and a $10,000 maximum benefit. The data from the *1972 Reports*, assumed to be applicable to claim costs at the midpoint of the period 1968–70, are projected forward two and a half years to January, 1972. This projected experience then is combined with the experience from the *1974 Reports* to produce one set of claim costs applicable to a January, 1972, midpoint.

Four sets of major medical claim costs, net premiums, and reserves appear in Volume II of the 1974 Medical Expense Tables. Values are

TABLE 13

COMPARISON OF TWO-YEAR PRELIMINARY TERM MIDTERMINAL RESERVE FACTORS
$100 MATERNITY BENEFIT
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

ISSUE AGE	POLICY YEAR 4		POLICY YEAR 8		POLICY YEAR 13		POLICY YEAR 18		POLICY YEAR 25		POLICY YEAR 35	
	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables	1956 Inter-company Hospital Table	1974 Medical Expense Tables
	Term-to-Age-65 Plan											
20....	−$27.76	−$27.57	−$87.94	−$88.54	−$134.51	−$130.72	−$152.22	−$139.40	−$138.43	−$122.28	−$ 82.41	−$ 72.67
25....	− 20.07	− 20.08	− 60.14	− 55.89	− 85.60	− 72.37	− 88.28	− 71.46	− 68.93	− 55.35	− 29.07	− 23.34
30....	− 12.50	− 9.58	− 35.62	− 25.33	− 44.94	− 30.63	− 39.77	− 26.93	− 26.50	− 17.95	− 1.56	− 1.05
35....	− 6.80	− 4.29	− 16.10	− 9.97	− 15.85	− 9.80	− 12.18	− 7.52	− 6.09	− 3.76	.....	.....
40....	− 1.83	− 1.14	− 3.03	− 1.89	− 2.35	− 1.45	− 1.54	− 0.95	− 0.12	− 0.07	.....	.....
	Lifetime Plan											
20....	−$29.01	−$28.67	−$92.84	−$92.86	−$144.57	−$139.68	−$168.44	−$153.82	−$165.39	−$146.16	−$131.67	−$116.20
25....	− 21.02	− 20.84	− 63.82	− 58.85	− 93.33	− 78.51	− 100.77	− 81.38	− 89.66	− 71.96	− 68.29	− 54.81
30....	− 13.12	− 10.00	− 38.02	− 26.96	− 49.89	− 34.02	− 47.78	− 32.43	− 40.27	− 27.34	− 29.39	− 19.96
35....	− 7.11	− 4.48	− 17.31	− 10.72	− 18.34	− 11.36	− 16.29	− 10.10	− 13.35	− 8.27	− 9.33	− 5.76
40....	− 1.91	− 1.19	− 3.33	− 2.07	− 2.97	− 1.84	− 2.59	− 1.60	− 2.06	− 1.28	− 1.39	− 0.86

shown based on charges assumed to be applicable as of January, 1972 ("1972 Level of Charges"), and on charges assumed to be applicable as of January, 1978 ("1978 Projected Level of Charges"). As explained later, the 1978 projected level of charges is exactly double the 1972 level. For each of these two levels of charges, separate values are shown for a major medical plan that duplicates medicare benefits and for a major medical plan with a provision for nonduplication of medicare benefits.

The pivotal net annual claim costs applicable to a 1972 level of major medical charges are derived by first projecting the claim amounts from the 1968–70 experience period to 1972 by multiplying by a factor of 1.333. This factor reflects an annual increase of 12.2 percent over a two-and-a-half-year period (from July, 1969, to January, 1972). These projected claim amounts are added to the claim amounts from the 1971–72 experience period. The combined claim amounts then are divided by the total number of lives exposed in both experience periods to produce the pivotal net annual claim costs. An example of this projection and combination process for a male life attained age 37 is shown in the following example.

MAJOR MEDICAL EXPENSE BENEFIT*

DERIVATION OF NET ANNUAL CLAIM COST, MALE ATTAINED AGE 37

NUMBER OF LIVES EXPOSED		AMOUNT OF CLAIMS		1972 CRUDE NET ANNUAL CLAIM COST
1972 Reports (1)	*1974 Reports* (2)	*1972 Reports* (3)	*1974 Reports* (4)	{[(3)×1.333+(4)]/[(1)+(2)]} (5)
5,842	1,957	$237,832	$99,573	$53.42

* $500 fixed deductible, 75 percent coinsurance, no inside limits, maximum benefits of $5,000, $7,500, and $10,000 combined.

Major Medical Benefit with Duplication of Medicare Benefits

A comparison of the values for ages 65 and over in Table 21 of the *1972 Reports* and the corresponding table in the *1974 Reports* indicates that there are problems in using the 1974 data. The number of claims at ages 65 and over for which data are shown in the *1972 Reports* is 8,353, compared to only 905 claims in the *1974 Reports*. The average claim amounts and net annual claim costs from the *1974 Reports* show an actual decrease for ages 65 and over as compared with corresponding values at ages 55–65, whereas the claim costs in the *1972 Reports* show a continuous increase with advancing age. Therefore, the claim costs at

ages 65 and over for a major medical benefit that duplicates medicare benefits are based exclusively on data from the *1972 Reports*.

As indicated previously, the major medical data taken from the *Reports* are based on a major medical plan with 75 percent coinsurance and various maximum benefits. Currently issued individual major medical policies commonly contain an 80 percent coinsurance factor. The data contained in the *1972* and *1974 Reports*, modified and combined as described above, are further modified to be consistent with a plan containing an 80 percent coinsurance factor and a $10,000 maximum benefit. The adjustment of claim costs based on a 75 percent coinsurance factor to claim costs based on an 80 percent coinsurance factor is made simply by multiplying by $\frac{80}{75}$. The adjustment of claim costs based on various maximum benefits to claim costs based on a $10,000 maximum benefit is performed by noting that for the 1971–72 experience period approximately 53, 43, and 4 percent of claims are on policies with maximum benefits of $10,000, $7,500, and $5,000, respectively. On the basis of an empirical continuance table of major medical claims, the aggregate increase in claim costs resulting from adjusting these data to a $10,000 maximum benefit level is calculated to be 4.66 percent. The combined effect of the coinsurance and maximum benefit adjustments is to multiply the claim costs based on the *1972* and *1974 Reports* by a factor of 1.116.

The net annual claim costs whose derivation and construction are described above are first developed for the central ages 22, 27, . . ., 77. These pivotal values are graduated by using the averaging interpolation process described previously. The resulting male net annual claim cost at attained age 22 is considered unrealistically high and is reduced to 125 percent of the claim cost for attained age 27. Claim costs below age 22 and above age 77 are determined as in the following formula, where S_y is the net annual claim cost at attained age y:

$$\begin{aligned} S_y &= S_{22}\,, && y < 22 \\ &= S_{77}[1 + 0.03(y - 77)]\,, && 77 < y \leq 99\,. \end{aligned}$$

Table 14 shows a comparison at selected ages of the crude net annual claim costs from the *1972* and *1974 Reports* with the corresponding claim costs from the 1974 Medical Expense Tables (1972 level of charges) and the major medical claim costs published in 1965 by Nelson and Warren, Inc. (all adjusted to an 80 percent coinsurance, $10,000 maximum benefit basis). The claim costs contained in the 1974 Medical Expense Tables show a striking increase over the costs published in 1965. Tables 15 and 16 give similar comparisons of net level annual premiums and

two-year preliminary term midterminal reserves. The material increase in net annual claim costs from the major medical table published in 1965 to the 1974 Medical Expense Tables results in dramatically higher net premiums and reserves.

Major Medical Benefit with Nonduplication of Medicare Benefits

The 1974 Medical Expense Tables also contain net annual claim costs and lifetime net premiums and reserves for the same major medical benefit as described above but with a provision for nonduplication of benefits paid under medicare. Under attained age 65, the claim costs for this benefit are the same as those for the major medical benefit that duplicates medicare benefits.

TABLE 14

COMPARISON OF NET ANNUAL CLAIM COSTS
MAJOR MEDICAL EXPENSE BENEFIT*

Attained Age	Crude Values from *TSA Reports*			Graduated Values	
	1972 Reports (1)	*1974 Reports* (2)	*1972* and *1974 Reports* Combined (3)	1974 Medical Expense Tables (4)	1965 Nelson and Warren Tables (5)
	Male				
27	$ 22.63	$ 21.39	$ 27.96	$ 28.12	$ 10.84
37	45.43	56.78	59.62	58.61	17.85
47	66.37	67.76	82.38	91.12	33.12
57	161.55	184.83	206.83	194.07	63.71
67	238.95	N.A.	318.51	318.18	117.18
77	388.61	N.A.	518.02	518.02	190.88
87	.....	.....	.....	673.43	310.93
	Female				
27	$ 36.81	$ 38.18	$ 46.35	$ 43.62	$ 18.89
37	41.49	65.83	58.02	60.91	23.80
47	85.81	96.09	109.06	105.18	45.07
57	128.53	140.97	163.40	155.05	63.71
67	147.98	N.A.	197.26	210.60	117.18
77	246.08	N.A.	328.03	328.03	190.88
87	.....	.....	.....	426.44	310.93

* $500 fixed deductible, 80 percent coinsurance, no inside limits, $10,000 maximum, duplication of medicare. *Cols. 1 and 2:* values from Table 21 of *Reports* multiplied by 1.116. *Col. 3:* 1968–70 experience from *1972 Reports* projected to January, 1972, then combined with 1971–72 experience from *1974 Reports;* resulting claim costs multiplied by 1.116. *Col. 4:* 1972 level of charges; duplication of medicare. *Col. 5:* values adjusted to 80 percent coinsurance, $10,000 maximum, according to adjustment factors in the 1965 publication.

TABLE 15

COMPARISON OF NET LEVEL ANNUAL PREMIUMS MAJOR MEDICAL EXPENSE BENEFIT $500 FIXED DEDUCTIBLE; 80 PERCENT COINSURANCE; $10,000 MAXIMUM BENEFIT 1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

Issue Age	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†
	Term-to-Age-65 Plan	
Male:		
25	$ 27.51	$ 80.74
35	37.41	110.70
45	52.02	150.10
55	72.41	214.21
Female:		
25	34.44	80.62
35	43.64	103.32
45	58.00	132.34
55	72.95	160.32
	Lifetime Plan	
Male:		
25	$ 38.96	$109.87
35	53.64	151.31
45	75.33	207.72
55	106.53	292.50
65	149.71	391.59
75	207.09	518.25
Female:		
25	45.24	97.07
35	58.98	125.42
45	79.89	161.89
55	106.83	202.62
65	149.71	256.17
75	207.09	329.27

* Adjusted to 80 percent coinsurance, $10,000 maximum benefit.

† 1972 level of charges; duplication of medicare.

TABLE 16

COMPARISON OF TWO-YEAR PRELIMINARY TERM MIDTERMINAL RESERVE FACTORS
MAJOR MEDICAL EXPENSE BENEFIT
$500 FIXED DEDUCTIBLE; 80 PERCENT COINSURANCE; $10,000 MAXIMUM BENEFIT
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

Issue Age	Policy Year 4		Policy Year 8		Policy Year 13		Policy Year 18		Policy Year 25		Policy Year 35	
	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†
	Term-to-Age-65 Plan											
Male:												
25..	$28.75	$ 90.37	$106.36	$328.87	$201.38	$ 593.52	$286.90	$ 813.10	$365.27	$1,051.21	$ 268.44	$ 774.87
35..	34.45	92.08	122.06	324.70	214.24	589.64	264.32	776.94	215.96	619.35	.....	.....
45..	35.23	109.63	109.02	352.48	146.48	450.35	88.88	242.60	.....	.....	.....	.....
55..	21.86	54.31	37.22	82.29	.....	.....	.....	.....	.....	.....	.....	.....
Female:												
25..	26.98	64.44	97.09	243.45	188.56	461.51	278.48	626.10	327.67	709.17	234.45	425.64
35..	35.10	74.87	124.96	247.43	197.29	391.70	221.79	438.82	185.55	305.06	.....	.....
45..	24.98	52.39	76.90	151.88	113.55	181.66	76.57	96.42	.....	.....	.....	.....
55..	21.86	19.56	37.22	31.44	.....	.....	.....	.....	.....	.....	.....	.....

* Adjusted to 80 percent coinsurance, $10,000 maximum benefit.

† 1972 level of charges; duplication of medicare.

TABLE 16—*Continued*

Issue Age	Policy Year 4		Policy Year 8		Policy Year 13		Policy Year 18		Policy Year 25		Policy Year 35	
	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables†	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†	1965 Nelson and Warren Tables*	1974 Medical Expense Tables†
	Lifetime Plan											
Male:												
25..	$47.94	$139.08	$181.31	$519.03	$356.98	$ 988.57	$538.14	$1,450.76	$786.33	$2,119.47	$1,066.08	$2,798.49
35..	61.77	160.26	229.12	591.87	438.56	1,149.55	632.97	1,697.10	862.51	2,232.87	1,037.95	2,549.85
45..	74.72	206.61	265.77	736.85	482.77	1,276.06	655.71	1,659.10	827.31	1,999.46	924.12	1,968.39
55..	80.73	187.47	277.16	625.36	465.27	1,058.57	608.94	1,380.23	730.69	1,453.52	754.04	1,122.21
Female:												
25..	45.08	91.80	167.74	350.28	335.21	683.30	515.39	984.36	724.50	1,309.36	985.81	1,562.59
35..	60.88	111.50	225.98	390.94	408.93	692.47	569.71	933.10	795.66	1,171.80	991.19	1,409.79
45..	62.32	101.96	224.89	348.36	431.55	603.75	622.04	820.50	793.60	1,074.63	902.38	1,079.23
55..	80.73	93.39	277.27	332.53	465.27	607.24	608.94	796.56	730.69	836.19	754.04	660.26

For attained ages 65 and over, the claim costs (1972 level of charges) for the major medical benefit with a nonduplication of medicare provision are developed by first computing, separately for males and females, an aggregate net annual claim cost for ages 65–79 based on the data contained in Table 21 of the *1974 Reports* only. Since the major medical claim costs at attained ages below 65 are a combination of the projected *1972* and *1974 Reports* data, these aggregate claim costs are increased by the ratio for attained ages 55–64 of the combined experience period claim costs to the *1974 Reports* net annual claim costs. This ratio is 1.152 for males and 1.116 for females. These modified values for ages 65–79 are made age-specific by first assuming that they are equal to the exact claim costs for attained age 72. (This is the average attained age, based on number of claims, from Table 21 of the *1974 Reports*.) Claim costs for the additional pivotal ages 62, 67, and 77 are then developed by using the slope of the corresponding claim costs for the duplication of medicare benefit. Ratios of these latter claim costs at ages 62, 67, and 77 to the claim cost at age 72 are developed and then applied to the age 72 nonduplication of medicare claim cost. An example of the development of the nonduplication of medicare claim costs is shown in Table 17. In order to be consistent with an 80 percent coinsurance, $10,000 maximum benefit, the final adjustment is to multiply the claim costs in column 8 of Table 17 by 1.116. The derivation of this factor was described in the preceding section.

Major Medical Values for a 1978 Projected Level of Charges

For each major medical benefit considered, Volume II of the 1974 Medical Expense Tables also contains values based on a 1978 projected level of charges. These values are exactly double the similar values based on a 1972 level of charges. This relationship is an empirical one and is not the result of any detailed study of the trend of provider charges. The use of an annual trend factor of 12.2 percent for six years, applied to the 1972 level of net annual claim costs, produces a doubling of claim costs, net premiums, and reserves.

No one can predict accurately what the trends in medical care costs will be over the period 1972–78. The 1977–78 intercompany major medical experience will be published in the *1980 Reports* and will not be available until the middle of 1981. The need for a major medical valuation table whose underlying experience is not out of date before it can be used is clear. The particular approach adopted here is consistent in that the annual trend factor of 12.2 percent has already been used to adjust the 1968–70 claims to a January, 1972, level. Also, the mathematical

compounding for six years produces a simple relationship that avoids the appearance of spurious accuracy.

As mentioned under "Special Problems of Valuing Benefits with Increasing Costs" in the Introduction, any approach to the valuation of major medical policies has its shortcomings. The publication of a valuation table based on a static projection of experience is a useful although imperfect solution.

Adjustment Tables for Major Medical Benefits

Major medical policies now in force and currently being sold involve many combinations of deductibles, coinsurance percentages, maximum benefits, and limitations on room and board benefits and physicians' benefits. It would be impractical to attempt to establish separate tables of claim costs, net premiums, and reserves for each combination. Therefore, the 1974 Medical Expense Tables contain tables of adjustment

TABLE 17

MAJOR MEDICAL EXPENSE BENEFIT*—NONDUPLICATION OF MEDICARE NET ANNUAL CLAIM COSTS ATTAINED AGES 65 AND OVER—MALE LIVES

A. DEVELOPMENT OF NET ANNUAL CLAIM COST (NACC) FOR ASSUMED AGE 72

1974 Reports, p. 99, Table 21, Ages 65–79			Ratio, *1972 Reports* and *1974 Reports* Combined NACC to *1974 Reports* NACC, Ages 55–64	Crude Age 72 NACC [(3)×(4)]
No. of Lives Exposed (1)	Amount of Claims (2)	NACC [(2)/(1)] (3)	(4)	(5)
2,414	$332,366	$137.68	$205.33/$178.22 = 1.152	$158.61

B. DEVELOPMENT OF NET ANNUAL CLAIM COSTS AT OTHER PIVOTAL AGES FROM AGE 72 NET ANNUAL CLAIM COST

Attained Age *y* (6)	Ratio, NACC at Age *y* to NACC at Age 72, Duplication of Medicare (7)	Nonduplication of Medicare Net Annual Claim Cost [(5)×(7)] (8)
62.....	0.6428	$101.98
67.....	0.8019	127.20
72.....	1.0000	158.61
77.....	1.3055	207.07

* $500 fixed deductible, 75 percent coinsurance, no inside limits, maximum benefits of $5,000, $7,500, and $10,000.

factors that are to be applied to the published values in order to value major medical plans with diverse benefit parameters. These adjustment factors, shown in Table 18, are derived from specially constructed empirical models.

Section A of Table 18 contains an array of factors for the various

TABLE 18

MAJOR MEDICAL EXPENSE BENEFIT

A. ADJUSTMENT FACTORS FOR VARIOUS FIXED DEDUCTIBLES AND MAXIMUM BENEFIT AMOUNTS

MAXIMUM BENEFIT	DEDUCTIBLE					
	$250	$500	$750	$1,000	$1,500	$2,000
$ 5,000	0.87	0.80	0.74	0.69	0.61	0.54
7,500	0.98	0.92	0.85	0.80	0.71	0.63
10,000	1.07	1.00	0.94	0.88	0.79	0.70
15,000	1.18	1.11	1.04	0.99	0.89	0.80
20,000	1.25	1.18	1.11	1.06	0.95	0.88
25,000	1.31	1.24	1.17	1.12	1.01	0.94
50,000	1.51	1.44	1.37	1.31	1.21	1.13
100,000	1.71	1.64	1.57	1.51	1.41	1.33
250,000	1.76	1.68	1.62	1.56	1.45	1.37

B. ADJUSTMENT FACTORS FOR VARIOUS INSIDE LIMITS

Daily Room and Board Limit	Factor	Surgical Schedule	Factor
	1972 Level of Charges		
$ 55 or more	1.00	$ 8.50 1964 CRVS or more	1.00
50	0.95	7.00 1964 CRVS	0.95
40	0.85	6.00 1964 CRVS	0.90
30	0.75	5.00 1964 CRVS	0.85
	1978 Projected Level of Charges		
$100 or more	1.00	$14.00 1964 CRVS or more	1.00
85	0.95	12.00 1964 CRVS	0.95
65	0.85	10.00 1964 CRVS	0.90
50	0.80	8.00 1964 CRVS	0.85

NOTE.—Factors for other level coinsurance percentages are in direct proportion to the standard 80 percent coinsurance factors. If the coinsurance percentage changes after a certain benefit level, the adjustment table for other maximum benefits can be used to determine the proportion of costs at each coinsurance percentage. Interpolation between values on a straight-line basis is sufficiently accurate.

combinations of six deductible amounts and nine maximum benefits, with the factor for a $500 deductible, $10,000 maximum benefit plan set at 1.00. These adjustment factors are constructed from a continuance table of major medical claims by size that is designed deliberately to include a high percentage of very large claims. This gives the appearance of producing reserves that are more conservative for large maximum benefits than for small maximum benefits. This approach is appropriate because of the differing effect of increases in provider charges on claim costs for various claim-size brackets, such as $0–$10,000, $10,000–$20,000, $20,000–$50,000, etc. The 12.2 percent annual increase factor referred to is considered to be applicable to the basic $500 deductible, $10,000 maximum claim costs; the excess cost of claims over $10,000 will increase at a much faster pace. The examples below demonstrate that an average claim and a very large claim can show increases in compensable charges of significantly different percentages, even though the percentage increase in provider charges is the same for both claims.

It should be kept in mind that the sample claims shown are only examples. However, they do serve to point out how the secular increase in charges can have a dramatic effect on compensable amounts in excess of a base amount, especially when the base amount is large. Because of this acceleration in compensable amounts for the higher portions of large

	1972 Level of Charges	1978 Projected Level of Charges
Average claim:		
Provider charges	$ 2,500	$ 4,500
Deductible	500	500
Covered charges	$ 2,000	$ 4,000
Compensable amount at 80%	$ 1,600	$ 3,200*
Very large claim:		
Provider charges	$15,000	$27,000
Deductible	500	500
Covered charges	$14,500	$26,500
Compensable at 80%—$10,000 maximum	$10,000	$10,000†
Compensable at 80%—$20,000 maximum	11,600	20,000†
Compensable at 80%—$50,000 maximum	11,600	21,200†

* Based on an 80 percent increase in provider charges over six years, the compensable amount for this claim doubles.

† Based on the same 80 percent increase in provider charges over six years, the increase in compensable amounts under $10,000 is zero. For the portion of the benefits between $10,000 and $20,000, the percentage increase in compensable amount is (20,000 − 11,600) ÷ (11,600 − 10,000), or 525 percent. For the portion of the benefits between $10,000 and $50,000, the percentage increase in compensable amount is 9,600 ÷ 1,600, or 600 percent.

maximum benefits, these major medical reserve adjustment factors are constructed by using a continuance table that overrepresents the proportion of large claims.

The major medical claim costs, net premiums, and reserves in the 1974 Medical Expense Tables are based on major medical plans with no inside limits for hospital room and board or for surgical charges. Section B of Table 18 contains two sets of adjustment factors for use in modifying the values when the major medical plan to be valued contains such inside limits. One set is based on the 1972 level of charges, and the other on the 1978 projected level of charges. Shown in Section A of Table 19 are

TABLE 19*

MAJOR MEDICAL EXPENSE BENEFIT

A. EXAMPLES OF RESERVE ADJUSTMENT FACTORS FOR INSIDE LIMITS

	Plan A	Plan B	Plan C	Plan D
Daily room and board limit	Semiprivate	$40	$55	$40
Surgical schedule†	UCR	UCR	$6 CRVS	$6 CRVS
Reserve adjustment factor (Table 18—1972 level of charges)	1.00	0.85	0.90	0.77

B. EXAMPLES OF COMPENSABLE BENEFIT AMOUNTS

	Covered Charges			
	Plan A	Plan B	Plan C	Plan D
Provider charges:				
Hospital room and board —$55 daily for 12 days: $660	$ 660	$ 480	$ 660	$ 480
Miscellaneous hospital charges: $600	600	600	600	600
Surgical (assume a relative value of 40): $340	340	340	240	240
Other expenses: $150	150	150	150	150
Total charges: $1,750	$1,750	$1,570	$1,650	$1,470
Deductible	$ 500	$ 500	$ 500	$ 500
Coinsurance (80%/20%)	250	214	230	194
Compensable amount	$1,000	$ 856	$ 920	$ 776

* In these examples, the relative sizes of the compensable amounts bear a close relationship to the reserve adjustment factors.

† UCR means coverage for usual, customary, and reasonable charges. CRVS means the 1964 California Relative Value Schedule.

the reserve adjustment factors, based on the 1972 level of charges, for four major medical plans with different inside limits. Section B of Table 19 shows the compensable amounts of benefits for a hypothetical major medical claim that is covered by the same four major medical plans, each with a $500 deductible and 80 percent/20 percent coinsurance. In this example, the relative sizes of the compensable amounts bear a close relationship to the reserve adjustment factors.

IX. CANCER EXPENSE BENEFIT

"Standard" Plan Benefits

Insurers offer many different types of cancer expense benefit policies with varying inside limits. However, a significant proportion of policies issued contain benefits that follow the same general pattern. For the cancer expense benefit, the net annual claim costs, net annual premiums, and reserve factors developed in Volume III of the 1974 Medical Expense Tables are based on a "standard" plan or set of benefits. This plan is offered by a number of insurers and is very similar in design to a number of other widely issued cancer policies. It consists of a series of specific benefits for such expenses as hospital charges, in-hospital drugs and medicine, surgery, and radiotherapy and chemotherapy. Almost all the listed benefits have a per-cause or lifetime maximum, while the overall lifetime maximum benefit is assumed to be $50,000. The standard plan is assumed to contain an extended hospital benefit that pays actual charges up to $5,000 per month following 90 days of continuous, uninterrupted hospital confinement due to cancer. A more detailed description of the benefits contained in the standard plan can be found in Table 21.

Sources of Data

Four major sources of data are used in the construction of the cancer benefit values. Since the intercompany experience taken from the *Reports* excludes maternity experience, the data taken from the other sources also exclude maternity experience, for reasons of consistency. Therefore, in the following paragraphs and tables, the term "all causes" of medical expense should be taken to mean all causes of medical expense excluding obstetrical causes.

1. One source of data is a National Cancer Institute study of the number of cancer cases and of cancer incidence rates among a large segment of the general population for the period 1969–1971. The portions of this study actually used are Tables 19C–19F, found on pages 104–11 of the Institute's Monograph No. 41. These tables show, separately for male and female lives, the number of cancer cases and the average annual cancer incidence rate per 100,000 of exposed population. The values are given in five-year

attained-age groups. In addition, the data are shown by primary site of the cancer and for all sites of cancer combined.

2. A second source is a study of the number of days spent in a hospital by type of illness, as prepared by a large midwestern hospital service insurer. As explained later, the results of this hospital utilization study are used to establish a relationship between the number of hospital days due to cancer and the total days of hospital confinement due to all causes of medical expense.
3. A third source of data is the experience of several insurance companies that write a relatively large volume of cancer insurance. This experience indicates the proportions of cancer benefits actually paid for each component benefit of the standard cancer plan. The main uses of this experience are to establish a proportion of claim costs among the various component benefits, and to serve as a basis for a recommended procedure whereby claim costs for a set of cancer benefits different from those in the standard plan can be evaluated in terms of the standard plan claim costs.
4. The fourth data source, contained in the *1974 Reports*, is the all-cause experience for underwritten medical expense policies for several types of benefits.

Development of Net Annual Claim Costs

OVERVIEW OF METHOD

The standard cancer plan net annual claim costs are developed in two distinct steps. First, theoretical claim costs are developed for each of the standard plan benefits (excluding radiotherapy and chemotherapy and the extended benefits) for all causes of injuries and sicknesses except for obstetrical. These claim costs for all causes then are multiplied by independently developed ratios of cancer hospital utilization to hospital utilization for all causes. These calculations are made at each of the attained ages 22, 27, . . . , 77, separately for male and female lives. The pivotal-attained-age results are graduated using the previously described curve-fitting process. These claim costs are extended beyond attained age 77 by means of the following linear extrapolation formula, where S_y is the net annual claim cost at attained age y:

$$S_y = S_{77}[1 + 0.03(y - 77)], \quad 77 < y \leq 99.$$

CLAIM COSTS FOR ALL CAUSES OF MEDICAL EXPENSE

In determining net annual claim costs for each of the standard plan benefits for all causes of medical expense combined, two tabular sources of data are used. For hospital benefits the source is the experience for individually underwritten lives as shown in the *1974 Reports*, page 75, Table 4, adjusted to the level of experience for durations 3 and later. For surgical benefits, the all-cause claim costs are those developed for

Volume I of these 1974 Medical Expense Tables. Net annual claim costs for the hospital and surgical benefits in the standard plan are developed directly from these tables.

Claim costs for the other component benefits in the standard plan are developed by making empirical adjustments to the available hospital and surgical claim costs. For example, the claim costs for the $10 daily physician attendance benefit in the standard plan are assumed to be equivalent to the claim costs for a $6 daily room and board hospital benefit. Claim costs for the blood and plasma standard plan benefit are taken to be the product of an estimated average claim of $100, the frequency of hospitalization shown in Table 4 of the *1974 Reports*, and an estimated utilization rate of 10 percent of those hospitalized. The dollar amounts of claim costs for all of the standard plan benefits (except radiotherapy and chemotherapy and extended benefits) are then totaled.

CANCER CLAIM COSTS

To obtain the age-by-age cancer net annual claim costs, the totals determined in the preceding section are multiplied by the ratios of cancer hospital utilization to hospital utilization for all causes of medical expense. These resulting cancer claim costs then are increased by 13 percent, with 10 percent representing the additional costs due to the radiotherapy and chemotherapy benefit and 3 percent representing the extra costs for the extended benefits.

The ratios of cancer hospital utilization to hospital utilization for all causes of medical expense are developed by a series of steps that are discussed below.

1. The number of cancer cases and the annual cancer incidence rates, by five-year attained-age groups and separately for male and female lives, are obtained from National Cancer Institute Monograph No. 41.
2. For each attained-age group, the total population exposed to cancer is taken to be the number of cancer cases divided by the cancer incidence rate.
3. For each of these attained-age population groups, an estimate is made of the total number of days of hospital confinement in a year's time for all causes of medical expense. This is done by multiplying the group's population by the hospital utilization rates shown in Table 4 of the *1974 Reports*. These projected numbers of all-cause hospital days for the entire population are summed over all attained ages, separately for male and female.
4. Data provided by the hospital service insurer mentioned earlier show that the number of cancer-related hospital confinement days is 8.2 percent of hospital confinement days due to all causes. The total number of cancer-related hospital days for the male and female population groups (all ages combined) then are taken as 8.2 percent of the total all-cause hospital days.

5. These non-age-specific cancer hospital days are distributed by attained-age groups according to the respective number of cancer cases for each attained-age group shown in Monograph No. 41.
6. As a preliminary estimate of the relationship of cancer hospital days to all-cause hospital days (by attained-age group and sex), the cancer hospital days from item 5 above are divided by the all-cause hospital days from item 3 above.
7. Because there is a tendency for cancer to be hereditary, some antiselection is possible. It is assumed that the relative incidence of cancer benefits is greater for lives insured for this specific risk than for a general population group. This hypothesis is incorporated into the final ratios of cancer hospital utilization to hospital utilization for all causes combined by multiplying the ratios in item 6 above by 200 percent at attained age 27, 190 percent at attained age 32, etc., with subsequent 10 percent reductions at each pivotal age so that the factor is 100 percent at attained age 77. For a population similar to the one underlying the National Cancer Institute statistics, the aggregate margins introduced by the use of these antiselection factors are 27.0 percent of the general population cancer claim costs for male lives and 33.1 percent for female lives.

COMPARISON OF ALL-CAUSE CLAIM COSTS AND CANCER CLAIM COSTS

Table 20 shows for pivotal ages the values by sex of the all-cause net annual claim costs; the ratios of cancer hospital utilization to all-cause hospital utilization, both excluding and including the margins for antiselection; and the final cancer net annual claim costs.

Test of the Distribution of Cancer Claim Costs by Component Benefit

As a result of the empirical methods used in developing the all-cause net annual claim costs for some of the component benefits, and also because of the independent and unrelated developments of the all-cause hospital utilization and the cancer hospital utilization relationships, a test of reasonableness of the distribution of cancer claim costs by component benefit is needed. This is done by comparing the theoretical distribution of cancer claim costs by component benefit with a breakdown by component benefit of a large volume of claim experience of one private insurer. These comparative values are shown in Table 21. The proportions developed from the theoretical all-cause claim costs, which are described in the second part of the section "Development of Net Annual Claim Costs," are shown in column 1. The actual proportions of cancer benefits paid by the large insurer are shown in column 2. The fact that the actual and theoretical proportions are reasonably close helps support the validity of the theoretical development. The final proportions of the 1974 Medical Expense Tables, which exclude the extended benefits, are shown in column 3. They tend to be even closer

to the proportions based on actual experience. They can be used in evaluating the benefits of a given cancer plan in terms of the benefits of the standard cancer plan. Shown in Table 22 is an example of the use of the proportions in column 3 of Table 21 to compute the reserve adjustment for a policy providing $60 per day for the first 7 days in a hospital, $40 per day thereafter, a $750 surgical schedule, and other benefits with the same limits as the standard plan. The net premiums and reserves would be 123.6 percent of the standard plan values.

Net Annual Premium and Midterminal Reserve Factors

Shown in Table 23 for a lifetime plan are some sample two-year preliminary term net annual premiums and midterminal reserve factors for the standard cancer plan at selected male and female ages.

TABLE 20

STANDARD CANCER EXPENSE BENEFIT ALL-CAUSE NET ANNUAL CLAIM COSTS, RATIOS OF CANCER HOSPITAL UTILIZATION TO ALL-CAUSE HOSPITAL UTILIZATION, AND CANCER NET ANNUAL CLAIM COSTS

Attained Age	All-Cause Net Annual Claim Costs*	Ratio of Cancer Hospital Utilization to All-Cause Hospital Utilization		Cancer Net Annual Claim Costs†
		With No Margin for Antiselection	With Margin for Antiselection	
	Male			
22	$ 40.60	.01677	.03354	$ 1.54
32	40.39	.02602	.04944	2.26
42	59.27	.04682	.07961	5.33
52	87.24	.09897	.14846	14.63
62	139.81	.15172	.19724	31.17
72	236.05	.15776	.17354	46.28
	Female			
22	$ 46.58	.01643	.03286	$ 1.73
32	65.96	.03477	.06606	4.93
42	90.67	.06833	.11616	11.90
52	94.38	.12625	.18938	20.19
62	109.45	.15472	.20114	24.87
72	179.61	.12269	.13496	27.39

* Excluding costs for radiotherapy, chemotherapy, and extended benefits.
† Including costs for radiotherapy, chemotherapy, and extended benefits.

TABLE 21

STANDARD CANCER EXPENSE BENEFIT
DISTRIBUTION OF CANCER CLAIM COSTS BY BENEFIT

	1974 Tables, Crude Values (1)	Claim Experience of One Insurer (2)	1974 Tables, Final Values* (3)
1. $50 per day, first 7 days of hospital confinement	35.1%	54.8%	35.0%
2. $30 per day, after first 7 days of hospital confinement	20.6		20.0
3. Drugs and medicine—actual expenses up to 10% of benefits paid in items 1 and 2 for drugs and medicine administered in hospital	3.4	4.9	5.0
4. Surgical schedule—$500 schedule maximum	15.4	17.5	17.4
5. Physician attendance in hospital—$10 per day, $600 lifetime limit	8.3	5.3	5.4
6. Private-duty nursing—$24 per day in hospital, $600 lifetime limit	1.3	1.4	1.4
7. Radiotherapy and chemotherapy—actual expense up to $1,000 for X-ray, radium, cobalt therapy, and chemotherapy—$1,000 lifetime limit	8.8	10.3	10.0
8. Anesthesia—actual expenses up to $70 for each operation, $30 for skin cancer	2.7	4.1	4.2
9. Blood and plasma—actual expenses to $300 lifetime limit, no limit for leukemia	1.2	1.4	1.4
10. Ambulance—actual expenses up to $50 per confinement, $500 lifetime limit	0.6	0.2	0.2
11. Extended benefits	2.6	0.1	.....
Total	100.0%	100.0%	100.0%

* Excluding extended benefits.

TABLE 22

EVALUATION OF BENEFITS OF NONSTANDARD CANCER PLAN

1. Hospital, first 7 days	35% × 60/50 = 42.0%
2. Hospital, after 7th day	20% × 40/30 = 26.7%
3. Drugs and medicine: 10 percent of items 1 and 2	5% × 68.7/55 = 6.2%
4. Surgical schedule	17.4% × 750/500 = 26.1%
5. Physician attendance	5.4%
6. Private-duty nursing	1.4%
7. Radiotherapy and chemotherapy	10.0%
8. Anesthesia	4.2%
9. Blood and plasma	1.4%
10. Ambulance	0.2%
Ratio of nonstandard plan benefits to standard plan benefits	123.6%

TABLE 23

1974 MEDICAL EXPENSE TABLES
STANDARD CANCER EXPENSE BENEFIT—LIFETIME PLAN
NET ANNUAL PREMIUMS AND MIDTERMINAL RESERVE FACTORS
TWO-YEAR PRELIMINARY TERM BASIS
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

ISSUE AGE	NET ANNUAL PREMIUM	MIDTERMINAL RESERVE FOR POLICY YEAR INDICATED					
		4	8	13	18	25	35
		Male					
25	$11.87	$15.71	$60.49	$121.65	$186.29	$270.79	$345.58
35	17.26	21.74	81.16	153.36	217.18	276.35	279.78
45	25.48	25.13	88.40	152.09	191.40	205.97	185.24
55	36.09	21.50	67.99	102.98	118.85	123.78	99.88
65	46.27	12.09	37.84	59.54	69.12	64.61	−1.16
		Female					
25	$13.17	$15.58	$57.02	$106.39	$146.13	$171.87	$165.03
35	17.93	16.03	53.35	84.15	99.62	103.94	93.82
45	22.53	8.78	27.53	41.68	48.19	52.50	60.86
55	25.48	4.44	13.96	22.81	31.93	43.81	41.08
65	27.70	3.62	14.22	27.26	34.27	33.37	−1.21

X. MEDICARE SUPPLEMENTARY EXPENSE BENEFITS

Volume III of the 1974 Medical Expense Tables contains net annual claim costs, net annual premiums, and two-year preliminary term mid-terminal reserve factors for a lifetime plan that provides medicare supplement benefits. Most medicare supplement policies contain benefits that parallel the deductibles and coinsurances that are payable under medicare. Under medicare Part A, there is an initial hospital deductible payable once per spell of illness and a daily deductible for the 61st to the 90th day of hospital confinement equal to 25 percent of the initial deductible. There is a lifetime reserve of 60 hospital days beyond the 90th day of hospital confinement with a daily deductible of 50 percent of the initial deductible. After hospital confinement, medicare Part A provides for the payment of extended care facility expenses for 100 days with a deductible of 12.5 percent of the initial deductible for each day between the 21st and the 100th day. Some medicare supplement policies provide for additional amounts of daily hospital indemnity for various periods of hospital confinement (such as from the 151st to the 365th

day, or from the 8th to the 60th day). Policies often provide for payment of the 20 percent coinsurance for physicians' in-hospital charges under medicare Part B.

The 1974 Medical Expense Tables contain values for two benefits that can be used in valuing medicare supplementary expense policies. The first of these is entitled the "medicare Part A deductible supplementary expense benefit." The benefits under this plan are based on a $100 initial medicare deductible and include benefits of $100 per hospital confinement, plus $25 per day from the 61st to the 90th day of hospital confinement, plus $50 per day from the 91st to the 150th day of hospital confinement, plus $12.50 per day from the 21st to the 100th day of confinement in an extended care facility. The second benefit is a hospital benefit of $100 per confinement that can be used in the approximate valuation of benefits where hospitalization is a necessary condition and for which an average charge per hospital confinement can be estimated. In addition, one can use this benefit to eliminate the initial hospital deductible from the medicare Part A deductible supplementary expense benefit if the contract to be valued does not cover the initial hospital deductible. Also shown in the tables are values for a $10 daily hospital benefit payable during each of the following periods of hospital confinement: 8th through 60th day, 61st through 90th day, 91st through 150th day, 151st through 365th day, and 8th through 365th day. These values can be used in the valuation of additional amounts of hospital indemnity above the medicare daily hospital deductibles.

Four basic sets of morbidity parameters are used in the construction of these medicare supplementary values, as follows: (1) frequencies of hospitalization; (2) average-stay values for the various periods of hospital confinement; (3) for those already hospitalized, frequencies of confinement in an extended care facility for at least 20 days; and (4) average-stay values beyond the 20th day of confinement in an extended care facility.

The hospital frequency rates are taken as 110 percent of the hospital frequencies at attained ages 65 and over as developed in Section II of this paper. The 10 percent margin is felt to be necessary and appropriate because a large number of medicare supplement policies are sold either on a guaranteed issue basis without regular underwriting, as conversions from term-to-age-65 medical expense policies, or with liberal underwriting standards.

The average-hospital-stay values are based on the values shown in the paper "Continuance Study of Hospital Claims on Individually Underwritten Lives Age 65 and Over" (*TSA*, XV, 530) and also on the

average-hospital-stay values as developed in Section III of this paper. The continuance values taken from the aforementioned paper, page 535, Table 3, are for ages 65 and over and for male and females lives combined. These continuance values are combined with specific age and sex values from the 1974 Medical Expense Tables to produce average stays for the required periods of hospital confinement. First, the average stay during the first 7 days of hospital confinement is set equal to 5.95 days, the average stay as computed from Table 3. This value is subtracted from the average-stay values by age and sex for a 90-day maximum daily hospital confinement to obtain average-stay values for the 8th through the 90th day of hospital confinement. To produce values for the respective periods of hospitalization mentioned above, the average-stay values for hospital days 8–90 are then multiplied by ratios of B to C computed from Table 3, where B is the average stay for each respective period of hospital confinement and C is the average hospital stay for the 8th through the 90th day of hospital confinement.

Shown in Table 24 of this paper are the average-stay values developed from Table 3 of the paper in *TSA*, Volume XV, together with an example of their use in calculating the average stay during the 61st through the 90th, the 91st through the 150th, and the 151st through the 365th days of hospital confinement for a male life at attained age 67. The technique described in the immediately preceding paragraph restricts the difference between the average-hospital-stay values developed from the paper in *TSA*, Volume XV, and the corresponding values developed for the 1974 Medical Expense Tables to the portion of the hospital stay in excess of the first 7 days. This approach is based on the assumption that pressure from the Social Security Administration has tended to reduce the average hospital stay for confinements lasting over 7 days but has had no effect on the first week of hospital confinement. This pressure can result from recertification programs, occasional denials of benefits for lengthy hospital stays, and other means.

The frequency rates of confinement in an extended care facility for at least 20 days for those already hospitalized are chosen to be consistent with the extended care admission rates for all medicare enrollees found in the *Social Security Bulletin Annual Statistical Supplement, 1973*, page 151, Table 135. The average number of days spent in an extended care facility beyond the 20th day is not based on any specific body of data but is chosen to produce what are considered adequately conservative claim costs for this benefit. Shown in Table 25 at selected attained ages are sample values of these parameters.

The net annual claim costs for these medicare supplement hospital

TABLE 24

MEDICARE SUPPLEMENT AVERAGE-HOSPITAL-STAY VALUES

A. AGE 65 AND OVER COMBINED MALE AND FEMALE AVERAGE-HOSPITAL-STAY VALUES

(Developed from *TSA*, XV, 535, Table 3)

	Period of Hospital Confinement				
	Days 1–7	Days 8–60	Days 61–90	Days 91–150	Days 151–365
Average stay (days)	5.9493	9.0043	0.7820	0.5778	0.4186
Ratio to days 8–90	0.6079	0.9201	0.0799	0.0590	0.0428

B. CALCULATION OF AVERAGE-STAY VALUES, MALE ATTAINED AGE 67

1. Average stay, days 1–90, from 1974 Medical Expense Tables	12.78
2. Average stay, days 1–7, from A above	5.95
3. Average stay, days 8–90 (line 1 — line 2)	6.83

	Period of Hospital Confinement		
	Days 61–90	Days 91–150	Days 151–365
4. Aggregate ratio of average stay, period of hospital confinement, to average stay, days 8–90 (from A above)	0.0799	0.0590	0.0428
5. Average stay, period of hospital confinement, male attained age 67 (line 3 × line 4)	0.5458	0.4030	0.2923

TABLE 25

MEDICARE SUPPLEMENT EXTENDED CARE BENEFIT VALUES

Attained Age, Male and Female	Frequency of Hospitalization		For Those Already Hospitalized, Frequency of Confinement* in an Extended Care Facility for at Least 20 Days	Average Number of Days in an Extended Care Facility beyond the 20th Day
	Male	Female		
62	.1979	.1962	.04	40
67	.2415	.2118	.05	44
72	.2905	.2320	.06	50
77	.3499	.2756	.07	54

* A qualified confinement is one occurring within fourteen days of a hospital confinement period of at least three days.

TABLE 26

1974 Medical Expense Tables
Medicare Part A Deductible Supplementary Expense Benefit
Net Annual Claim Costs, Net Annual Premiums, and Midterminal Reserves

Attained Age	Net Annual Claim Costs				
	$100 Initial Hospital Deductible	$25 Daily Benefit Hospital Confinement Days 61-90	$50 Daily Benefit Hospital Confinement Days 91-150	$12.50 Daily Benefit, Extended Care Confinement Days 21-100	Total
	Male				
67	$24.15	$3.29	$4.87	$ 6.64	$38.95
72	29.05	4.75	7.03	10.89	51.72
77	34.99	6.64	9.81	16.62	68.06
	Female				
67	$21.18	$2.74	$4.05	$ 5.82	$33.79
72	23.20	3.75	5.53	8.70	41.18
77	27.56	5.21	7.69	13.09	53.55

Issue Age	Net Annual Premiums*	Midterminal Reserves* for Policy Year Indicated				
		4	8	13	18	25
	Male					
65	$50.44	$25.70	$83.06	$122.34	$132.16	$118.67
70	59.58	22.17	61.89	84.69	89.46	59.98
75	69.18	13.37	39.69	54.57	48.57	−5.85
80	76.83	9.69	26.40	28.09	−1.59	.....
85	83.68	5.14	10.22	−11.01	.....	.....
	Female					
65	$41.14	$17.04	$58.35	$ 90.26	$ 99.27	$ 90.12
70	47.19	16.93	48.15	66.20	70.06	46.99
75	54.42	10.52	31.23	42.95	38.23	−4.60
80	60.45	7.62	20.79	22.11	−1.25	.....
85	65.84	4.04	8.04	−8.67	.....	.....

* Two-year preliminary term basis; 1958 CSO Mortality Table, 3 percent interest; lifetime plan.

confinement benefits are constructed at pivotal ages by taking the product of three numbers—the applicable amount of indemnity, the frequency of hospitalization, and the average compensable stay for each hospital component. The extended care confinement net annual claim costs are taken as the product of four numbers—the applicable amount of indemnity, the frequency of hospitalization, the relative frequency of extended care confinement for at least a 20-day period, and the compensable extended care stay. For the medicare Part A deductible supplementary expense benefit, the initial deductible is $100. With this $100 taken as a unit value, the amounts of daily benefits payable for hospital days 61–90, hospital days 91–150, and extended care days 21–100 are $25, $50, and $12.50, respectively. Net annual claim costs above age 77 are determined by first extending both the hospital frequency rates and the average-stay values, using the methods described in Sections II and III of this paper, and then multiplying together the extended frequencies and average-stay values.

Shown in Table 26 are sample values of net annual claim costs and two-year preliminary term net annual premiums and midterminal reserves for the medicare Part A supplementary expense benefit.

XI. SUMMARY

The material presented in this paper describes the approaches and techniques used to construct the basic morbidity values contained in the 1974 Medical Expense Tables. These techniques are not the only ones that could have been used. In the construction of many of the morbidity values, alternative techniques were tested and their results considered. The final techniques chosen are those that are felt to have the most merit and the least objections. The alternative techniques are not shown or discussed, since the purpose of the paper, already lengthy, is to record the final techniques only.

There are many interesting studies and investigations that can be generated by considering intercompany morbidity statistics, proper reserves based on these statistics, and the application of these statistics to the pricing of products. One possible subject for study concerns the assumption of secular trends in the calculation of reserves for benefits whose claim costs tend to increase with provider charges, and for policies that provide for automatic increases in benefits, such as certain medicare supplement policies. Another item is the effect of such a reserve calculation approach upon the initial pricing of those benefits and upon subsequent rate revisions. We have made only passing reference to these topics, in order to concentrate on the primary objective of describing

the construction of the 1974 Medical Expense Tables. However, those discussing this paper or writing a separate paper will be doing the Society a service by exploring these subjects in detail.

Companies that have a credible amount of ultimate experience on benefits not currently included in the intercompany data shown in the *Reports* could perform a useful service by submitting this experience as part of a discussion of this paper.

APPENDIX I

The formulas used to compute the values in the 1974 Medical Expense Tables are shown below.

A. COMMUTATION FUNCTIONS

$$H_x = \tfrac{1}{2}(D_x + D_{x+1})S_x\ ;$$

$$K_x = \sum_{t=x}^{\omega} H_t\ , \qquad \omega = 99\ ;$$

$$K_{\frac{1}{x:\overline{65-x}|}} = \sum_{t=x}^{64} H_t\ ;$$

$$N_x = \sum_{t=x}^{\omega} D_t\ , \qquad \omega = 99\ .$$

D_x is computed using the 1958 CSO Mortality Table with a radix of 10,000,000 and an interest rate of 3 percent. Therefore, the N_x and D_x values from the Society of Actuaries Basic Values volume and the 1974 Medical Expense Tables are the same. The D_x values are rounded to one decimal place before the H_x values are computed.

S_x is the net annual claim cost. Values for specific benefits are obtained as described in this paper. Values of S_x used are rounded to two decimal places.

The values of H_x are rounded to the nearest integer.

B. NET LEVEL ANNUAL PREMIUMS

1. *Lifetime Net Single Premium*

$$A_x = K_x/D_x.$$

2. *Lifetime Net Annual Premium*

$$P_x = K_x/N_x\ .$$

3. *Term-to-Age-65 Net Single Premium*

$$A_{\frac{1}{x:\overline{65-x}|}} = K_{\frac{1}{x:\overline{65-x}|}}/D_x$$

4. *Term-to-Age-65 Net Annual Premium*

$$P_{\frac{1}{x:\overline{65-x}|}} = K_{\frac{1}{x:\overline{65-x}|}}/(N_x - N_{65}) .$$

The net annual premiums are used without rounding to produce the terminal reserves. For display purposes, the premiums are rounded to the nearest cent.

C. TERMINAL RESERVES

1. *Lifetime Terminal Reserve (Two-Year Preliminary Term)*

$$\overset{*}{}_{t}V_x = (P_{x+t} - P_{x+2})(N_{x+t}/D_{x+t}) .^{2}$$

2. *Term-to-Age-65 Terminal Reserve (Two-Year Preliminary Term)*

$$\overset{*}{}_{t}V_{x:\overline{65-x}|} = (P_{\frac{1}{x+t:\overline{65-x-t}|}} - P_{\frac{1}{x+2:\overline{65-x-2}|}})(N_{x+t} - N_{65})/D_{x+t} .$$

Terminal reserves are used without rounding to produce midterminal reserves. For display purposes, rounding is to the nearest cent.

D. MIDTERMINAL RESERVES

1. *Lifetime Midterminal Reserve (Two-Year Preliminary Term)*

$$\overset{*}{}_{t}V_x^{\text{MID}} = \tfrac{1}{2}({}_{t-1}\overset{*}{V}_x + \overset{*}{}_{t}V_x) .$$

2. *Term-to-Age-65 Midterminal Reserve (Two-Year Preliminary Term)*

$$\overset{*}{}_{t}V^{\text{MID}}_{\frac{1}{x:\overline{65-x}|}} = \tfrac{1}{2}({}_{t-1}\overset{*}{V}_{\frac{1}{x:\overline{65-x}|}} + \overset{*}{}_{t}V_{\frac{1}{x:\overline{65-x}|}}) .$$

[2] The asterisk denotes a two-year preliminary term reserve.

APPENDIX II

TABLE A

1974 MEDICAL EXPENSE TABLES
NET ANNUAL CLAIM COSTS—HOSPITAL AND SURGICAL BENEFITS

ATTAINED AGE	$10 DAILY HOSPITAL BENEFIT		$100 PER CONFINEMENT HOSPITAL BENEFIT		$200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT		$100 MAXIMUM SURGICAL BENEFIT		$100 MATERNITY BENEFIT
	Male	Female	Male	Female	Male	Female	Male	Female	
15	$ 6.11	$ 6.23	$ 9.28	$12.21	$14.45	$18.45	$ 2.08	$ 2.27	$30.38
16	6.11	6.23	9.28	12.21	14.45	18.45	2.08	2.27	30.38
17	6.11	6.23	9.28	12.21	14.45	18.45	2.08	2.27	30.38
18	5.72	6.27	8.79	12.09	13.88	18.74	1.97	2.18	30.38
19	5.39	6.34	8.36	11.98	13.38	19.02	1.87	2.12	30.38
20	5.12	6.40	7.99	11.89	12.94	19.29	1.79	2.09	30.38
21	4.89	6.49	7.67	11.82	12.56	19.56	1.72	2.08	28.74
22	4.72	6.59	7.42	11.76	12.27	19.82	1.66	2.11	27.10
23	4.60	6.70	7.23	11.72	12.05	20.08	1.62	2.17	25.46
24	4.51	6.83	7.09	11.69	11.90	20.33	1.59	2.26	23.78
25	4.48	6.96	7.01	11.68	11.85	20.59	1.57	2.36	22.05
26	4.48	7.11	6.97	11.68	11.86	20.85	1.56	2.48	20.29
27	4.51	7.27	6.98	11.70	11.95	21.14	1.57	2.60	18.50
28	4.58	7.43	7.03	11.73	12.12	21.43	1.59	2.72	16.57
29	4.68	7.60	7.12	11.77	12.35	21.73	1.61	2.85	14.49
30	4.82	7.80	7.25	11.83	12.65	22.05	1.65	2.99	12.41
31	4.98	8.00	7.40	11.91	12.99	22.40	1.69	3.12	10.46
32	5.16	8.21	7.57	12.00	13.38	22.75	1.73	3.26	8.80
33	5.37	8.43	7.76	12.11	13.82	23.14	1.77	3.40	7.46
34	5.60	8.68	7.97	12.24	14.30	23.56	1.82	3.55	6.34
35	5.86	8.93	8.19	12.38	14.80	23.98	1.87	3.69	5.40
36	6.12	9.18	8.42	12.52	15.33	24.40	1.92	3.83	4.57
37	6.40	9.44	8.65	12.67	15.87	24.82	1.98	3.96	3.80
38	6.69	9.69	8.88	12.82	16.42	25.24	2.04	4.07	3.08
39	6.99	9.94	9.11	12.97	16.97	25.64	2.10	4.17	2.44
40	7.30	10.19	9.35	13.13	17.55	26.05	2.16	4.25	1.89
41	7.63	10.45	9.60	13.29	18.15	26.45	2.23	4.31	1.40
42	7.98	10.71	9.85	13.46	18.75	26.84	2.29	4.37	1.00
43	8.34	10.99	10.11	13.64	19.37	27.24	2.35	4.42	0.67
44	8.71	11.30	10.37	13.83	19.97	27.64	2.41	4.45	0.41
45	9.11	11.59	10.65	14.02	20.60	28.02	2.47	4.46	0.23
46	9.51	11.92	10.93	14.22	21.23	28.42	2.54	4.47	0.13
47	9.92	12.24	11.21	14.42	21.86	28.81	2.61	4.45	0
48	10.35	12.58	11.50	14.63	22.50	29.22	2.69	4.40	0
49	10.78	12.93	11.79	14.84	23.15	29.61	2.78	4.31	0
50	11.23	13.29	12.09	15.05	23.81	29.99	2.89	4.21	0
51	11.72	13.66	12.41	15.26	24.50	30.38	3.00	4.11	0
52	12.23	14.06	12.75	15.48	25.23	30.80	3.13	4.04	0
53	12.78	14.48	13.11	15.70	25.99	31.23	3.26	3.98	0
54	13.37	14.89	13.49	15.91	26.79	31.64	3.41	3.93	0

TABLE A—*Continued*

Attained Age	$10 Daily Hospital Benefit		$100 per Confinement Hospital Benefit		$200 Maximum Miscellaneous Hospital Benefit		$100 Maximum Surgical Benefit		$100 Maternity Benefit
	Male	Female	Male	Female	Male	Female	Male	Female	
55	$14.03	$15.37	$13.90	$16.14	$27.65	$32.09	$3.56	$3.89	0
56	14.74	15.85	14.35	16.36	28.58	32.53	3.72	3.86	0
57	15.52	16.37	14.84	16.59	29.58	32.98	3.90	3.84	0
58	16.40	16.95	15.38	16.83	30.69	33.45	4.08	3.84	0
59	17.37	17.57	15.98	17.07	31.91	33.92	4.27	3.85	0
60	18.42	18.22	16.61	17.32	33.18	34.40	4.47	3.88	0
61	19.57	18.93	17.29	17.58	34.55	34.91	4.66	3.92	0
62	20.78	19.66	17.99	17.84	35.96	35.41	4.85	3.97	0
63	22.08	20.45	18.73	18.11	37.45	35.92	5.04	4.03	0
64	23.46	21.25	19.50	18.38	38.98	36.42	5.24	4.11	0
65	24.91	22.10	20.30	18.65	40.58	36.92	5.43	4.19	0
66	26.43	23.01	21.11	18.95	42.19	37.48	5.62	4.28	0
67	28.05	23.93	21.95	19.25	43.87	38.03	5.81	4.39	0
68	29.73	24.91	22.80	19.55	45.56	38.58	5.99	4.50	0
69	31.53	25.90	23.67	19.83	47.30	39.08	6.18	4.63	0
70	33.38	27.01	24.56	20.16	49.07	39.69	6.35	4.75	0
71	35.34	28.23	25.48	20.56	50.89	40.43	6.52	4.87	0
72	37.34	29.59	26.41	21.09	52.72	41.43	6.69	5.00	0
73	39.51	31.20	27.42	21.77	54.70	42.73	6.83	5.12	0
74	41.91	33.01	28.53	22.56	56.85	44.26	6.94	5.23	0
75	44.42	34.93	29.67	23.41	59.05	45.91	7.04	5.35	0
76	46.85	36.84	30.78	24.25	61.16	47.54	7.18	5.48	0
77	49.15	38.60	31.81	25.05	63.10	49.10	7.36	5.63	0
78	51.11	40.14	32.76	25.80	64.98	50.57	7.58	5.80	0
79	53.14	41.74	33.72	26.55	66.88	52.04	7.80	5.97	0
80	55.16	43.33	34.67	27.30	68.77	53.51	8.02	6.14	0
81	57.26	44.98	35.63	28.06	70.67	54.99	8.24	6.31	0
82	59.33	46.61	36.58	28.81	72.56	56.46	8.46	6.47	0
83	61.49	48.27	37.54	29.56	74.46	57.93	8.68	6.64	0
84	63.62	49.98	38.49	30.31	76.34	59.40	8.91	6.81	0
85	65.83	51.68	39.44	31.06	78.23	60.87	9.13	6.98	0
86	68.03	53.44	40.40	31.81	80.13	62.34	9.35	7.15	0
87	70.30	55.21	41.35	32.57	82.02	63.83	9.57	7.32	0
88	72.34	56.84	42.18	33.22	83.66	65.11	9.79	7.49	0
89	74.39	58.46	43.00	33.87	85.29	66.38	10.01	7.66	0
90	76.53	60.10	43.83	34.52	86.94	67.66	10.23	7.83	0
91	78.65	61.81	44.66	35.18	88.58	68.95	10.45	7.99	0
92	80.84	63.49	45.49	35.83	90.23	70.22	10.67	8.16	0
93	82.99	65.23	46.31	36.48	91.86	71.50	10.89	8.33	0
94	85.23	66.95	47.14	37.13	93.50	72.77	11.11	8.50	0
95	87.45	68.68	47.97	37.78	95.15	74.05	11.33	8.67	0
96	89.73	70.48	48.79	38.43	96.77	75.32	11.56	8.84	0
97	92.00	72.26	49.62	39.08	98.42	76.59	11.78	9.01	0
98	94.29	74.12	50.45	39.74	100.07	77.89	12.00	9.18	0
99	96.64	75.93	51.27	40.39	101.69	79.16	12.22	9.35	0

TABLE B

1974 MEDICAL EXPENSE TABLES
NET ANNUAL CLAIM COSTS—MAJOR MEDICAL EXPENSE BENEFIT
($500 Fixed Deductible; 80 Percent Coinsurance; $10,000 Maximum)

Attained Age	1972 Level of Charges				Projected 1978 Level of Charges			
	Duplication of Medicare Benefits		Nonduplication of Medicare Benefits		Duplication of Medicare Benefits		Nonduplication of Medicare Benefits	
	Male	Female	Male	Female	Male	Female	Male	Female
15...	$ 34.94	$ 38.08	$ 34.94	$ 38.08	$ 69.88	$ 76.16	$ 69.88	$ 76.16
16...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
17...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
18...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
19...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
20...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
21...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
22...	34.94	38.08	34.94	38.08	69.88	76.16	69.88	76.16
23...	32.03	39.30	32.03	39.30	64.06	78.60	64.06	78.60
24...	29.82	40.45	29.82	40.45	59.64	80.90	59.64	80.90
25...	28.39	41.55	28.39	41.55	56.78	83.10	56.78	83.10
26...	27.79	42.60	27.79	42.60	55.58	85.20	55.58	85.20
27...	28.12	43.62	28.12	43.62	56.24	87.24	56.24	87.24
28...	29.38	44.45	29.38	44.45	58.76	88.90	58.76	88.90
29...	31.41	45.06	31.41	45.06	62.82	90.12	62.82	90.12
30...	34.01	45.68	34.01	45.68	68.02	91.36	68.02	91.36
31...	36.95	46.51	36.95	46.51	73.90	93.02	73.90	93.02
32...	40.03	47.76	40.03	47.76	80.06	95.52	80.06	95.52
33...	43.40	49.53	43.40	49.53	86.80	99.06	86.80	99.06
34...	47.19	51.77	47.19	51.77	94.38	103.54	94.38	103.54
35...	51.15	54.44	51.15	54.44	102.30	108.88	102.30	108.88
36...	55.03	57.50	55.03	57.50	110.06	115.00	110.06	115.00
37...	58.61	60.91	58.61	60.91	117.22	121.82	117.22	121.82
38...	61.90	64.66	61.90	64.66	123.80	129.32	123.80	129.32
39...	65.11	68.71	65.11	68.71	130.22	137.42	130.22	137.42
40...	68.28	72.98	68.28	72.98	136.56	145.96	136.56	145.96
41...	71.46	77.39	71.46	77.39	142.92	154.78	142.92	154.78
42...	74.68	81.86	74.68	81.86	149.36	163.72	149.36	163.72
43...	77.83	86.37	77.83	86.37	155.66	172.74	155.66	172.74
44...	80.88	90.95	80.88	90.95	161.76	181.90	161.76	181.90
45...	84.00	95.62	84.00	95.62	168.00	191.24	168.00	191.24
46...	87.36	100.36	87.36	100.36	174.72	200.72	174.72	200.72
47...	91.12	105.18	91.12	105.18	182.24	210.36	182.24	210.36
48...	96.10	110.07	96.10	110.07	192.20	220.14	192.20	220.14
49...	102.87	115.02	102.87	115.02	205.74	230.04	205.74	230.04
50...	111.21	119.99	111.21	119.99	222.42	239.98	222.42	239.98
51...	120.90	124.99	120.90	124.99	241.80	249.98	241.80	249.98
52...	131.73	129.98	131.73	129.98	263.46	259.96	263.46	259.96
53...	143.48	135.00	143.48	135.00	286.96	270.00	286.96	270.00
54...	155.89	140.05	155.89	140.05	311.78	280.10	311.78	280.10

TABLE B—*Continued*

Attained Age	1972 Level of Charges				Projected 1978 Level of Charges			
	Duplication of Medicare Benefits		Nonduplication of Medicare Benefits		Duplication of Medicare Benefits		Nonduplication of Medicare Benefits	
	Male	Female	Male	Female	Male	Female	Male	Female
55...	$168.66	$145.10	$168.66	$145.10	$ 337.32	$ 290.20	$337.32	$290.20
56...	181.49	150.11	181.49	150.11	362.98	300.22	362.98	300.22
57...	194.07	155.05	194.07	155.05	388.14	310.10	388.14	310.10
58...	206.33	159.61	206.33	159.61	412.66	319.22	412.66	319.22
59...	218.46	163.76	218.46	163.76	436.92	327.52	436.92	327.52
60...	230.55	167.83	230.55	167.83	461.10	335.66	461.10	335.66
61...	242.71	172.17	242.71	172.17	485.42	344.34	485.42	344.34
62...	255.04	177.12	255.04	177.12	510.08	354.24	510.08	354.24
63...	267.41	182.49	267.41	182.49	534.82	364.98	534.82	364.98
64...	279.73	188.12	279.73	188.12	559.46	376.24	559.46	376.24
65...	292.19	194.41	129.89	71.25	584.38	388.82	259.78	142.50
66...	304.95	201.77	135.80	74.09	609.90	403.54	271.60	148.18
67...	318.18	210.60	141.94	77.45	636.36	421.20	283.88	154.90
68..	332.40	220.89	148.43	81.29	664.80	441.78	296.86	162.58
69...	347.76	232.11	155.29	85.42	695.52	464.22	310.58	170.84
70...	363.87	243.91	162.43	89.74	727.74	487.82	324.86	179.48
71...	380.34	255.94	169.70	94.14	760.68	511.88	339.40	188.28
72...	396.79	267.84	177.01	98.50	793.58	535.68	354.02	197.00
73...	417.35	280.02	186.18	102.98	834.70	560.04	372.36	205.96
74...	443.75	292.74	197.95	107.65	887.50	585.48	395.90	215.30
75...	471.99	305.38	210.54	112.30	943.98	610.76	421.08	224.60
76...	498.08	317.35	222.18	116.70	996.16	634.70	444.36	233.40
77...	518.02	328.03	231.09	120.63	1,036.04	656.06	462.18	241.26
78...	533.56	337.87	238.02	124.25	1,067.12	675.74	476.04	248.50
79...	549.10	347.71	244.96	127.87	1,098.20	695.42	489.92	255.74
80...	564.64	357.55	251.89	131.49	1,129.28	715.10	503.78	262.98
81...	580.18	367.39	258.82	135.11	1,160.36	734.78	517.64	270.22
82...	595.72	377.23	265.75	138.72	1,191.44	754.46	531.50	277.44
83...	611.26	387.08	272.69	142.34	1,222.52	774.16	545.38	284.68
84...	626.80	396.92	279.62	145.96	1,253.60	793.84	559.24	291.92
85...	642.34	406.76	286.55	149.58	1,284.68	813.52	573.10	299.16
86...	657.89	416.60	293.48	153.20	1,315.78	833.20	586.96	306.40
87...	673.43	426.44	300.42	156.82	1,346.86	852.88	600.84	313.64
88...	688.97	436.28	307.35	160.44	1,377.94	872.56	614.70	320.88
89...	704.51	446.12	314.28	164.06	1,409.02	892.24	628.56	328.12
90...	720.05	455.96	321.22	167.68	1,440.10	911.92	642.44	335.36
91...	735.59	465.80	328.15	171.29	1,471.18	931.60	656.30	342.58
92...	751.13	475.64	335.08	174.91	1,502.26	951.28	670.16	349.82
93...	766.67	485.48	342.01	178.53	1,533.34	970.96	684.02	357.06
94...	782.21	495.33	348.95	182.15	1,564.42	990.66	697.90	364.30
95...	797.75	505.17	355.88	185.77	1,595.50	1,010.34	711.76	371.54
96...	813.29	515.01	362.81	189.39	1,626.58	1,030.02	725.62	378.78
97...	828.83	524.85	369.74	193.01	1,657.66	1,049.70	739.48	386.02
98...	844.37	534.69	376.68	196.63	1,688.74	1,069.38	753.36	393.26
99...	859.91	544.53	383.61	200.25	1,719.82	1,089.06	767.22	400.50

TABLE C

1974 MEDICAL EXPENSE TABLES

NET ANNUAL CLAIM COSTS—STANDARD CANCER EXPENSE BENEFIT

Attained Age	Male	Female	Attained Age	Male	Female
15	$ 1.54	$ 1.73	60	$27.71	$24.23
16	1.54	1.73	61	29.44	24.55
17	1.54	1.73	62	31.17	24.87
18	1.54	1.73	63	32.92	25.18
19	1.54	1.73	64	34.69	25.49
20	1.54	1.73	65	36.45	25.78
21	1.54	1.73	66	38.16	26.05
22	1.54	1.73	67	39.81	26.32
23	1.59	1.99	68	41.29	26.54
24	1.64	2.26	69	42.61	26.70
25	1.70	2.55	70	43.82	26.86
26	1.76	2.85	71	45.02	27.07
27	1.83	3.16	72	46.28	27.39
28	1.90	3.48	73	47.56	27.82
29	1.97	3.81	74	48.81	28.33
30	2.05	4.15	75	50.09	28.94
31	2.14	4.53	76	51.45	29.65
32	2.26	4.93	77	52.95	30.45
33	2.41	5.36	78	54.54	31.36
34	2.59	5.83	79	56.13	32.28
35	2.81	6.35	80	57.72	33.19
36	3.06	6.92	81	59.30	34.10
37	3.34	7.58	82	60.89	35.02
38	3.64	8.33	83	62.48	35.93
39	3.97	9.16	84	64.07	36.84
40	4.34	10.05	85	65.66	37.76
41	4.79	10.97	86	67.25	38.67
42	5.33	11.90	87	68.84	39.59
43	5.99	12.91	88	70.42	40.50
44	6.74	14.01	89	72.01	41.41
45	7.58	15.13	90	73.60	42.33
46	8.47	16.17	91	75.19	43.24
47	9.39	17.03	92	76.78	44.15
48	10.31	17.74	93	78.37	45.07
49	11.26	18.39	94	79.95	45.98
50	12.26	19.00	95	81.54	46.89
51	13.37	19.60	96	83.13	47.81
52	14.63	20.19	97	84.72	48.72
53	16.05	20.80	98	86.31	49.63
54	17.58	21.41	99	87.90	50.55
55	19.20	22.01			
56	20.88	22.56			
57	22.57	23.07			
58	24.27	23.51			
59	25.99	23.89			

TABLE D

1974 MEDICAL EXPENSE TABLES

NET ANNUAL CLAIM COSTS—MEDICARE SUPPLEMENT BENEFITS

ATTAINED AGE	$100 PER CONFINEMENT HOSPITAL BENEFIT		MEDICARE PART A DEDUCTIBLE SUPPLEMENTARY EXPENSE BENEFIT		$10 DAILY HOSPITAL BENEFIT 8TH-60TH DAY		$10 DAILY HOSPITAL BENEFIT 61ST-90TH DAY		$10 DAILY HOSPITAL BENEFIT 91ST-150TH DAY		$10 DAILY HOSPITAL BENEFIT 151ST-365TH DAY		$10 DAILY HOSPITAL BENEFIT 8TH-365TH DAY	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
65	$22.34	$20.51	$34.70	$31.43	$12.97	$11.11	$1.13	$0.97	$0.83	$0.71	$0.61	$0.52	$15.54	$13.30
66	23.24	20.83	36.77	32.57	14.04	11.85	1.22	1.03	0.90	0.76	0.66	0.55	16.81	14.18
67	24.15	21.18	38.95	33.79	15.17	12.63	1.32	1.10	0.97	0.81	0.71	0.59	18.17	15.12
68	25.08	21.51	41.28	35.07	16.39	13.47	1.42	1.17	1.05	0.86	0.77	0.63	19.63	16.12
69	26.04	21.83	43.76	36.44	17.69	14.36	1.54	1.25	1.13	0.92	0.83	0.67	21.18	17.19
70	27.02	22.19	46.35	37.89	19.05	15.30	1.65	1.33	1.22	0.99	0.89	0.71	22.81	18.31
71	28.02	22.63	49.01	39.47	20.46	16.26	1.78	1.41	1.31	1.05	0.95	0.76	24.50	19.47
72	29.05	23.20	51.72	41.18	21.89	17.25	1.90	1.50	1.40	1.11	1.02	0.80	26.22	20.65
73	30.17	23.94	54.76	43.30	23.51	18.43	2.04	1.60	1.50	1.18	1.09	0.85	28.16	22.06
74	31.39	24.80	58.25	45.89	25.37	19.86	2.20	1.72	1.62	1.28	1.18	0.92	30.39	23.78
75	32.64	25.74	61.85	48.65	27.29	21.38	2.37	1.85	1.75	1.37	1.27	1.00	32.69	25.59
76	33.87	26.68	65.23	51.31	29.09	22.82	2.53	1.97	1.87	1.47	1.35	1.07	34.84	27.31
77	34.99	27.56	68.06	53.55	30.58	23.99	2.66	2.08	1.96	1.54	1.42	1.12	36.63	28.72
78	36.04	28.38	70.46	55.43	31.82	24.95	2.76	2.17	2.04	1.60	1.48	1.16	38.10	29.88
79	37.09	29.21	72.87	57.33	33.07	25.93	2.87	2.25	2.12	1.66	1.54	1.21	39.60	31.06

TABLE D—*Continued*

Attained Age	$100 per Confinement Hospital Benefit		Medicare Part A Deductible Supplementary Expense Benefit		$10 Daily Hospital Benefit 8th-60th Day		$10 Daily Hospital Benefit 61st-90th Day		$10 Daily Hospital Benefit 91st-150th Day		$10 Daily Hospital Benefit 151st-365th Day		$10 Daily Hospital Benefit 8th-365th Day	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
80	$38.14	$30.03	$ 75.25	$59.19	$34.34	$26.92	$2.98	$2.34	$2.20	$1.73	$1.60	$1.25	$41.12	$32.24
81	39.19	30.87	77.70	61.15	35.63	27.95	3.09	2.43	2.29	1.79	1.66	1.30	42.66	33.47
82	40.24	31.69	80.18	63.08	36.93	28.96	3.21	2.52	2.37	1.86	1.72	1.35	44.23	34.69
83	41.29	32.52	82.67	65.04	38.26	30.01	3.32	2.61	2.46	1.93	1.78	1.40	45.81	35.93
84	42.34	33.34	85.18	67.01	39.60	31.05	3.44	2.70	2.54	1.99	1.84	1.44	47.42	37.19
85	43.38	34.17	87.64	68.96	40.95	32.12	3.56	2.79	2.63	2.06	1.90	1.49	49.04	38.47
86	44.44	34.99	90.22	70.96	42.34	33.20	3.68	2.88	2.72	2.13	1.97	1.54	50.70	39.76
87	45.49	35.83	92.79	73.01	43.74	34.31	3.80	2.98	2.81	2.20	2.03	1.60	52.38	41.08
88	46.40	36.54	95.09	74.81	45.02	35.31	3.91	3.07	2.89	2.27	2.09	1.64	53.91	42.28
89	47.30	37.26	97.40	76.64	46.31	36.33	4.02	3.15	2.97	2.33	2.15	1.69	55.45	43.50
90	48.21	37.97	99.68	78.42	47.62	37.35	4.14	3.24	3.06	2.40	2.21	1.74	57.02	44.72
91	49.13	38.70	102.06	80.31	48.96	38.40	4.25	3.34	3.14	2.46	2.28	1.79	58.62	45.99
92	50.04	39.41	104.43	82.16	50.30	39.45	4.37	3.43	3.23	2.53	2.34	1.83	60.23	47.24
93	50.94	40.13	106.81	84.05	51.65	40.52	4.49	3.52	3.31	2.60	2.40	1.88	61.85	48.52
94	51.85	40.84	109.22	85.93	53.03	41.59	4.60	3.61	3.40	2.67	2.47	1.93	63.50	49.81
95	52.77	41.56	111.60	87.80	54.43	42.69	4.73	3.71	3.49	2.74	2.53	1.98	65.18	51.12
96	53.67	42.27	114.03	89.71	55.83	43.79	4.85	3.80	3.58	2.81	2.60	2.04	66.85	52.43
97	54.58	42.99	116.49	91.65	57.25	44.91	4.97	3.90	3.67	2.88	2.66	2.09	68.56	53.77
98	55.50	43.71	118.99	93.61	58.70	46.04	5.10	4.00	3.77	2.95	2.73	2.14	70.29	55.13
99	56.40	44.43	121.47	95.58	60.14	47.18	5.22	4.10	3.86	3.03	2.80	2.19	72.02	56.50

DISCUSSION OF PRECEDING PAPER

E. PAUL BARNHART:

Messrs. Houghton and Wolf are to be commended for undertaking a study that is long overdue. The 1956 Intercompany Hospital and Surgical Tables are, without question, the most obsolete reserve tables that still enjoy official recognition as "statutory minimum standards." Not only are they old from the standpoint of years but, since such tables as the miscellaneous hospital expense tables deal with benefits subject to powerful secular trends, they have become ridiculously inappropriate. Even in terms of maximums, most policies today contain limits far in excess of anything included in the tables.

I have served for the last two years as chairman of an actuarial advisory committee to the National Association of Insurance Commissioners (NAIC) Task Force on Valuation and Nonforfeiture Standards, and one of our committee's most pressing questions has been how to replace or update these ancient tables in a useful, valid, and timely way. Consequently, upon seeing this paper, I was ready to utter a sigh of relief, sit back, and simply applaud.

I do find that I am experiencing some problems with the techniques described in the paper and with some of the resulting tables. Most of my troubles stem from the fact that, in the construction of almost every table in the paper, the authors make use of composite adjustments and projections that are applied very broadly and that in some cases have the effect of ignoring significant trends or of disregarding age-specific or other inherent differences that have to be taken into account if valid results are to be achieved. Some of the factors and projections used are applied over far too wide a spectrum.

Before getting into specific examples of these problems relating to trends and inherent differences, I want to comment on Section IV and Appendix II, Table A, of the paper, concerning the daily hospital benefit. Table A provides net annual claim costs for a zero-day elimination, 90-day maximum daily hospital benefit of $10, and in Section IV the authors make reference to Table C of the paper "Reserves for Individual Hospital and Surgical Expense Insurance" by Edwin L. Bartleson and James J. Olsen (*TSA*, IX, 339), which gives factors for converting to other maximum periods. Since these factors date back many years and do not vary by age, it would be useful to test them against more recent age-specific data. Further, many policies in force today contain elimina-

tion periods, often varying between accident and sickness hospitalization, and it is probably more important to provide factors for adjustment to other elimination periods than to other maximum periods.

For these purposes, I have included Tables 1 and 2 of this discussion. Table 1 provides claim costs for various elimination and maximum periods, by age and sex. Table 2 provides the two-element continuance function parameters used to generate Table 1. The formulas for computation with the parameters are the same as those given in *TSA*, XXV, 157–58. Interest discount can be ignored in hospital continuance. These tables have been labeled the "1974 Hospital Continuance Table" because they have been adjusted to reproduce fairly closely the hospitalization frequencies and average claims in the *1974 Reports*, Table 4, page 75. Except for this adjustment to conform to these values in the *1974 Reports*, the actual continuance patterns and the accident factors in the table have been derived from the claim experience, involving several hundred thousand hospital claims, of two clients of mine. The results also have been compared to group hospital continuance data published in the *Reports*. The accident factors, shown in the right-hand column of Table 2, represent the fraction of total hospitalization expected to arise from accidents, and are used in constructing those values in Table 1 where accident benefits differ from sickness benefits. The assumption is that the continuance pattern for accident confinement is the same as that for accident and sickness confinements combined; the source data did not provide for separate graduations for accident and sickness.

The following is a comparison of Table 1 conversion ratios at sample ages with the Bartleson-Olsen ratios:

Maximum Period in Days	Male				Female			
	Bartleson-Olsen, Table C	Table 1			Bartleson-Olsen, Table C	Table 1		
		Age 27	Age 47	Age 67		Age 27	Age 47	Age 67
14	.....	0.78	0.74	0.62	.....	0.86	0.79	0.66
30(31)	0.88	0.91	0.90	0.83	0.91	0.96	0.93	0.87
90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
180	1.05	1.03	1.03	1.05	1.04	1.01	1.01	1.03
365(360)	1.09	1.05	1.06	1.08	1.07	1.01	1.02	1.04
Unlimited	.....	1.11	1.13	1.16	.....	1.01	1.02	1.05

For maximum periods of less than 90 days, the age variation is quite significant, as would be expected from the considerable variation in aver-

TABLE 1

1974 HOSPITAL CONTINUANCE TABLE
NET ANNUAL CLAIM COSTS PER $10 DAILY HOSPITAL BENEFIT

AGE	ACCIDENT:SICKNESS ELIMINATION PERIOD IN DAYS/ACCIDENT:SICKNESS MAXIMUM PERIOD IN DAYS											
	0:0/ 90:90	0:0/ 90:0	0:3/ 90:90	3:3/ 90:90	0:5/ 90:90	5:5/ 90:90	7:7/ 90:90	0:0/ 14:14	0:0/ 30:30	0:0/ 180:180	0:0/ 365:365	0:0/ Unlimited
Male:												
17	$ 6.900	$3.105	$ 5.406	$ 4.183	$ 4.853	$ 3.178	$ 2.500	$ 5.629	$ 6.438	$ 7.024	$ 7.106	$ 7.273
22	4.733	1.893	3.658	2.942	3.257	2.274	1.819	3.761	4.348	4.857	4.946	5.140
27	4.135	1.488	3.162	2.615	2.795	2.041	1.648	3.233	3.763	4.264	4.361	4.585
32	4.761	1.476	3.594	3.069	3.138	2.409	1.949	3.697	4.329	4.911	5.023	5.299
37	5.890	1.413	4.371	3.891	3.754	3.080	2.504	4.520	5.343	6.074	6.214	6.577
42	7.209	1.369	5.346	4.909	4.556	3.934	3.223	5.428	6.505	7.440	7.619	8.104
47	8.985	1.347	6.696	6.292	5.688	5.107	4.224	6.610	8.045	9.285	9.518	10.180
52	11.092	1.552	8.412	7.976	7.199	6.566	5.497	7.913	9.801	11.497	11.807	12.723
57	14.098	1.832	10.919	10.444	9.440	8.744	7.431	9.634	12.205	14.683	15.114	16.401
62	18.674	2.054	14.741	14.255	12.849	12.129	10.449	12.188	15.838	19.511	20.085	21.769
67	26.146	2.091	21.048	20.605	18.490	17.825	15.566	16.175	21.679	27.368	28.121	30.216
72	34.148	2.390	27.896	27.425	24.673	23.960	21.095	20.377	27.889	35.766	36.682	39.101
Female:												
17	5.826	2.039	4.013	3.037	3.383	2.068	1.460	5.280	5.677	5.857	5.864	5.866
22	5.674	1.702	3.930	3.183	3.286	2.262	1.660	4.990	5.475	5.714	5.725	5.726
27	6.395	1.598	4.455	3.808	3.695	2.795	2.106	5.476	6.125	6.445	6.458	6.461
32	7.872	1.653	5.535	4.913	4.571	3.694	2.836	6.590	7.500	7.937	7.954	7.957
37	9.610	1.922	6.910	6.235	5.750	4.785	3.737	7.858	9.098	9.694	9.718	9.722
42	11.070	2.435	8.195	7.384	6.923	5.754	4.552	8.869	10.413	11.179	11.211	11.217
47	11.806	2.715	8.918	8.056	7.612	6.359	5.090	9.269	11.015	11.952	11.998	12.008
52	12.157	2.674	9.336	8.541	8.025	6.860	5.579	9.252	11.195	12.353	12.420	12.436
57	12.974	2.724	10.151	9.400	8.801	7.691	6.362	9.505	11.753	13.244	13.346	13.374
62	15.493	3.098	12.397	11.623	10.865	9.707	8.179	10.810	13.761	15.885	16.046	16.098
67	21.173	4.234	17.394	16.449	15.451	14.021	12.030	13.947	18.386	21.765	22.025	22.127
72	28.137	5.908	23.648	22.455	21.275	19.451	16.936	17.547	23.844	29.057	29.497	29.715

TABLE 2

1974 HOSPITAL CONTINUANCE TABLE

(Unit: 1 Day, Valuing a Benefit of $1 per Day)

AGE	h_1 FUNCTION				h_2 FUNCTION				
	α	α'	a	y, b	α	α'	a	y, b	Accident Factor
Male:									
17.....	6.400	11.80	3.3500	−1.0	0.3289	20.50	1.5000	−1.0	0.45
22.....	5.450	11.60	3.2799	−1.0	0.3167	21.20	1.4750	−1.0	0.40
27.....	5.250	11.80	3.2750	−1.0	0.3021	22.00	1.4499	−1.0	0.36
32.....	6.340	13.40	3.4300	−1.0	0.3013	22.70	1.4250	−1.0	0.31
37.....	7.900	15.50	3.6000	−1.0	0.3144	23.30	1.3999	−1.0	0.24
42.....	10.020	18.40	3.8100	−1.0	0.3324	23.90	1.3749	−1.0	0.19
47.....	11.980	20.90	3.9200	−1.0	0.3572	24.50	1.3500	−1.0	0.15
52.....	12.700	21.80	3.8000	−1.0	0.3884	25.10	1.3249	−1.0	0.14
57.....	12.440	21.50	3.4900	−1.0	0.4275	25.60	1.3000	−1.0	0.13
62.....	13.350	22.60	3.3000	−1.0	0.4598	26.10	1.2799	−1.0	0.11
67.....	16.400	26.20	3.2700	−1.0	0.4748	26.50	1.2599	−1.0	0.08
72.....	20.020	30.00	3.3399	−1.0	0.4954	27.00	1.2499	−1.0	0.07
Female:									
17.....	18.850	25.00	7.0900	−1.0	46.9000	159.00	5.6999	−1.0	0.30
22.....	18.850	26.00	6.6900	−1.0	48.5000	159.00	5.6599	−1.0	0.23
27.....	20.100	28.00	6.4800	−1.0	49.8000	160.00	5.6099	−1.0	0.18
32.....	23.520	32.00	6.6399	−1.0	50.8000	160.00	5.5400	−1.0	0.13
37.....	27.050	36.00	6.7800	−1.0	51.6000	161.00	5.4299	−1.0	0.10
42.....	30.630	40.00	7.0000	−1.0	51.6000	161.00	5.2799	−1.0	0.10
47.....	34.990	45.00	7.4200	−1.0	51.6000	162.00	5.0899	−1.0	0.09
52.....	38.900	50.00	7.6600	−1.0	50.8000	163.00	4.8600	−1.0	0.09
57.....	42.750	55.00	7.7599	−1.0	49.2000	163.00	4.5900	−1.0	0.11
62.....	46.700	60.00	7.5700	−1.0	47.1000	164.00	4.2800	−1.0	0.16
67.....	52.050	66.00	7.2300	−1.0	43.9000	165.00	3.9300	−1.0	0.17
72.....	58.700	73.00	7.0899	−1.0	39.8000	166.00	3.5400	−1.0	0.20

age claim by age. For maximums over 90 days, the age variation is much less but still of some significance.

Here are some of the more obvious instances where I believe the techniques used by the authors ignore or distort trends or inherent differences in the data:

1. In working with the miscellaneous hospital expense benefit (Sec. V), the authors employ uniform projection ratios that do not vary by age in projecting the crude $200 maximum average claim amounts from the *1972* and *1974 Reports* forward to January 1, 1977. An inspection of the two *Reports*, however, shows that the projection rates should vary by age, for the obvious reason that the average claim amounts increase with age and the values at younger ages therefore will exhibit higher rates of increase in relation to the $200 maximum. Thus, if we take the ratios of the average claims from

the *1974 Reports* to those from the *1972 Reports* (Table 5 in each case), we obtain the following:

Age	Ratio of 1974 to 1972 Average Claims	
	Male	Female
17	131%	130%
27	115	115
37	110	109
57	110	110

Hence, the uniform factors used by the authors tend to understate projected values for younger ages and to overstate values for older ages, a defect of significance in tables proposed for use in valuing reserves on age-graded level premium policies. Moreover, it would seem that this defect readily could have been avoided. In Table 6 of the paper, which contains samples of the resulting values, five of the values reach the $200 maximum and are truncated at this maximum level. All five of these examples occur at higher ages, where the uniform projection rates tend to overstate.

2. I have a similar problem with the uniform factors given near the end of Section V for converting the $200 maximum values to higher maximums. Here it would seem that a substantial distortion in the opposite direction must be expected to occur, that is, uniform factors used at all ages to convert $200 maximum costs to costs for a much higher maximum, such as $1,000, will produce a cost slope that is much too flat by advancing age. The "alternative method" described by the authors in the paragraph immediately preceding the factor table, which is based on assumptions as to progressive average miscellaneous charges in relation to increasing length of stay, surely would produce factors grading upward significantly with increasing age if applied to an age-specific hospital continuance table.

   I do not believe that the convenience and simplicity of a single uniform set of adjustment factors offset the distortions that result. It would seem that without undue difficulty the authors might have constructed specific tables for a limited set of increasing maximums such as $200, $500, $1,000, $2,000, and $5,000, and then provided rules or illustrations for interpolating among such tables or projecting the values in relation to secular trend. This would have made this section of the paper much more valuable and usable. As it is, the factors provided in the paper are much too simplistic, in my opinion.

3. In Table 12 of Section VII, the authors show examples of maternity frequency rates from their graduated 1974 Medical Expense Tables compared with crude values from the *1972* and *1974 Reports*, respectively. The rates from the 1974 Medical Expense Tables were derived by combining directly

the values from the two *Reports* using numbers of claims as weights. However, birth rates have been declining over the last two decades, and Table 12 shows that for every age (except 47) the 1974 Medical Expense Table values exceed the *1974 Reports* values. This is the result of the direct combination method used by the authors, which disregards completely the strong secular trend so clearly in evidence between the *1972 Reports* exposure years and the *1974 Reports* exposure years.

4. With respect to Section VIII and Table B, I have to question at the very outset whether Table 21 of the *Reports* (from any year) represents a satisfactory basis for the development of claim costs proposed for statutory valuation use without extensive preliminary analysis of the general unit cost levels reflected in the Table 21 experience. Table 21 relates to experience under policies without inside limits and represents the contributed experience of five companies (in the *1972* and *1974 Reports*). Moreover, all the experience on the $10,000 maximum benefit comes from a single large contributor. This one company contributed roughly 80 percent of the Table 2 adult data in the *1972 Reports* and well over 50 percent of that in the *1974 Reports*.

   Even though there are no inside limits per se, it is obvious that the geographical distribution of the claim experience is of major importance. It is one thing if much of the experience is concentrated in such high unit cost areas as Boston, Cleveland, Los Angeles, or New York. It is a different thing if a substantial portion of the experience comes from lower unit cost areas in the Midwest or the Southeast. The experience of a company with a large part of its business in New York or Los Angeles would be expected to differ dramatically from that of a company with a high proportion of its in-force in smaller cities of the Midwest, South, or Southeast. It surely would be inequitable for both companies to use the same Table B basis in valuing their policy reserves. In view of this, I think that an entirely different approach has to be taken for major medical benefit valuation, such as the "valued unit" method that I will discuss shortly.

5. Also in Section VIII, the authors use a factor of 1.33 ($1.122^{2.5}$) to project the claim volumes in Table 21 of the *1972 Reports* forward to January, 1972, in order to update them to the exposure period covered by the *1974 Reports*. The only explanation for this 12.2 percent annual trend rate that I can find in the paper is in the discussion concerning the 1978 projected level of charges, where it is stated that "the use of an annual trend factor of 12.2 percent for six years, applied to the 1972 level of net annual claim costs, produces a doubling of claim costs, net premiums, and reserves." The statement also is made that "the mathematical compounding for six years produces a simple relationship that avoids the appearance of spurious accuracy." Since most insurers actually have experienced annual trend rates on major medical benefits of 15 percent up to even about 25 percent, why not use, say, 18.9 percent, which would compound to 200 percent in four years, or

some other equally convenient rate? A rate of 12.2 percent to equate the 1972 with the 1974 data actually appears too high, however, because an examination of Table 21 of the *1974 Reports* shows that the 1.33 factor used by the authors actually exceeds every age-sex-specific ratio of 1971–72 to 1968–70 claim costs except those for females aged 30–44 and for children. Accordingly, in Table 14 of the paper the crude net annual claim costs for "*1972* and *1974 Reports* Combined" exceed the *1974 Reports* costs for every value shown, except, of course, for females aged 37. The "combined" values look overstated because of the arbitrary 12.2 percent annual trend rate applied.

We really appear to have an arbitrary projection of the *1972 Reports* data, with the much smaller volume of 1974 data then combined into these projected *1972 Reports* values. In my opinion, the result of this compound projecting and combining should be labeled "*Projected* 1972 Level of Charges," similar to the label the authors have given to the "Projected 1978 Level of Charges." As it is, I think more historical authenticity is being given to the costs associated with the 1972 level of charges than is merited.

6. Another very basic problem that I have with the major medical section relates to Table 18. Here we are given adjustment factors for various deductibles, maximum benefit amounts, and inside limits. The factors are uniform with respect to age and sex, and Section A of the table is also uniform with respect to secular trend, that is, the same factors are to be applied to either the 1972 level of costs or the projected 1978 level of costs. For example, to adjust from the basic $500 deductible, $10,000 maximum values to $1,500 deductible, $10,000 maximum values in either the 1972 level table or the projected 1978 level table, a factor of 79 percent is to be applied at any age for either sex.

One must expect substantial distortion to result from this uniform procedure. Inspection of Table 21 of either the *1972* or the *1974 Reports* shows that average claims at the higher ages tend to reach levels equal to 200 percent or more of the values at young ages, and the projected 1978 level costs automatically are 200 percent of the 1972 level costs. Therefore, it seems incredible that the same 79 percent factor for a $1,500 deductible could produce even remotely satisfactory results for all these different cells. If no better methods were available, perhaps we should have to use a device such as Table 18 because of its tempting simplicity. However, better actuarial tools have been available for many years, such as "valued unit" methodology,[1] which actually is quite easy to apply.

In order to provide some relative tests of the variations expected to arise by age, sex, and cost level in relation to deductibles and maximums, I have employed Table 1 on pages 31 and 32 of *TSA*, Volume XXI, which operates directly on the valued unit principle. Even though this table was con-

[1] "Revised Tables for Major Medical Benefits," *TSA*, XXI, 21.

structed from claim experience going back to the period 1961–67, its construction on a valued unit basis was intended to give it some "projection value." As a test of how well it may hold up in relation to more recent *TSA Reports* experience, I have constructed the following claim costs (interpolated for absolute dollar limits and central ages) from this table and compared them with the Table 21 costs in the *1972 Reports*, using this *Reports* number because it includes a much larger volume of claims than the *1974 Reports*. I used a unit value of $8, which is subject to my own criticism as stated in item 6 that we do not know the average unit cost level underlying the Table 21 data. However, this should give at least some relative feel for the claim cost levels projected by means of Table 1 of *TSA*, Volume XXI. For the 1968–70 experience period in Table 21 of the *1972 Reports*, an $8 unit value is equivalent to a $40 average daily room charge and a 1964 CRV unit value of $8.

ANNUAL CLAIM COSTS, MAJOR MEDICAL BENEFIT
($500 Deductible, $10,000 Maximum Benefit)

Age	Male			Female		
	A	B	B/A	A	B	B/A
22	$ 28.13	$ 23.89	0.849	$ 29.12	$ 33.87	1.163
27	20.28	26.68	1.315	32.98	42.80	1.297
32	24.79	32.04	1.292	32.54	53.87	1.655
37	40.71	40.50	0.994	37.18	66.82	1.797
42	62.57	52.11	0.832	52.62	79.83	1.517
47	59.47	67.83	1.140	76.89	90.92	1.182
52	90.32	88.44	0.979	83.68	102.24	1.221
57	144.76	113.71	0.785	115.17	116.20	1.008
62	178.16	146.92	0.824	122.41	138.80	1.133
67	214.11	191.72	0.895	132.60	176.61	1.331

Note.—A = *1972 Reports*, Table 21; B = *TSA*, XXI, 31–32, Table 1, k = $8.

The B values tend to be somewhat flatter by age than the A values, a characteristic also noted with respect to the male costs in *TSA*, XXI, 28, in a comparison with Table 22 of the *1967 Reports*. This would mean, however, that if the age slope of B were closer to that of A the disparity in ratios to other deductible/maximum combinations would be even greater than such ratios derived from Table 1.

In addition, the female costs in Table 21 of the *1972 Reports* are highly peculiar at ages 32, 37, and 42, the three points at which the B/A ratios are the highest. At 37 and 42, they actually fall below the corresponding male costs, and the female age 37 cost is the only value in Table 21 of the *1972 Reports* that is less than 100 percent of the corresponding female cost in the *1969 Reports*, at 96 percent. The following table shows the ratios of the female to male crude claim costs from Table 21 of each of the *1969*, *1972*,

and *1974 Reports*, for the $200 miscellaneous hospital benefit from the same *Reports* (Table 8 for *1969* and Table 7 for *1972* and *1974*), from the authors' Table B, and from *TSA*, XXI, 31–32, Table 1, $k = \$8$.

RATIOS OF FEMALE TO MALE CLAIM COSTS

Central Age	Table 21, *1969 Reports*	Table 21, *1972 Reports*	Table 21, *1974 Reports*	Authors' Table B	*TSA*, XXI, 31–32, Table 1, $k=\$8$	Table 8, *1969 Reports*	Table 7, *1972 Reports*	Table 7, *1974 Reports*
27.....	207%	163%	178%	155%	160%	165%	157%	174%
32.....	168	131	176	119	168	180	169	184
37.....	208	93	116	104	165	173	172	168
42.....	153	84	163	110	153	163	162	166
47.....	135	129	142	115	134	148	144	142
52.....	91	93	117	99	116	115	117	114

A comparison of the Table 21, *1972 Reports* ratios against all the other *Reports* ratios shown suggests that an anomaly exists at ages 30–44 in the female data in Table 21 of the *1972 Reports* that may render the data unsuitable as the primary source for a valuation table, and that this anomaly carries over into the authors' Table B.

Table 3 of this discussion shows claim costs for selected ages and various plan combinations calculated from *TSA*, XXI, 31–32, Table 1. Table 3 shows the ratio of each cost to a base cost, which is for $k = \$11$, a $500 deductible, and a $10,000 maximum. This unit cost level, equivalent to a $55 daily room charge and a 1964 CRV unit value of $11, is selected as a base because it comes close to the inside limit level for which the authors use a factor of 1.00 in relation to their 1972 level of charges. The k-value of $20 is equivalent to a $100 daily room charge, for which the authors use a factor of 1.00 under their 1978 level.

While the ratios of Table 3 should be taken only in a relative sense, they do indicate that appropriate adjustment factors should vary significantly with any of the variables: age, sex, or level of charges. This is exactly what one reasonably would expect, and I do not believe that Table 18 can be appropriate as a basis for the adjustment of costs over such a wide spectrum of ages and plans and for both sexes.

One might argue that the effect should average out over a company's total portfolio. But what if, say, the company writes only a $1,500 deductible plan, or its business is concentrated in a particularly low-cost or particularly high-cost geographical area? With the invariable factors of Table 18, the situation easily will arise where a particular portfolio of in-force business will be either excessively overvalued or undervalued.

I think that a company should derive costs appropriate for its particular business by a valued unit method such as I have used in Table 3 or, which

leads indirectly to the same result, should use costs consistent with the actuarial basis of its own gross premium structure or, best of all, should use costs consistent with its own actual experience. Any arbitrary basis unrelated to a company's gross premiums or experience, such as the basis underlying Table B and Table 18 of the paper, is likely to produce results that are inappropriate for any particular company.

7. With regard to the cancer expense benefit (Sec. IX), I have several of the same concerns about broad combinations, especially as to age variations. For example, in steps 4, 5, and 6 of the process of constructing cancer benefit costs by age, I question the application of the 8.2 percent factor at all ages. Here it is difficult to apply meaningful tests against any other standard. While I have my own cancer claim costs tables that I use in pricing such plans for clients, there is little point in including them here for comparison purposes because insufficient experience exists to support my values any more than those constructed by the authors.

In conclusion, while I have serious reservations about certain of the tables, adjustments, and projections for the reasons indicated, I still regard this paper as a contribution of great value, especially because I think it draws fresh attention to the obsolete nature of the 1956 Intercompany Hospital and Surgical Tables and helps to demonstrate how badly outdated these old standards have become. In spite of the concerns I have expressed, I think that the 1974 Medical Expense Tables represent a major improvement over the corresponding 1956 tables and that, with the possible exception of the maternity benefit values, the basic Table A and Table C values provide a satisfactory current valuation basis.

I do not, however, believe that the adjustment factors recommended in the paper for hospital maximum confinement periods other than 90 days or for miscellaneous hospital benefit maximums in excess of $200 are satisfactory, because of the lack of age-sex variations. Also, I think that a satisfactory current maternity table should take more account of the recent secular trend under this benefit (which would have the result, in general, of reducing the negative reserve credit usually generated under this benefit).

For major medical benefits, with their infinite variation in cost by plan, age, sex, and geography, I really believe that more harm than good arises from any attempt to establish a fixed, regulatory "minimum valuation standard." There comes a point where the professional judgment of the actuary who is pricing and valuing the benefit simply has to be relied upon, at least in preference to some arbitrary and absolute minimum regulatory standard that may or may not come anywhere close to being

TABLE 3

RATIOS OF CLAIM COSTS FOR VARIOUS MAJOR MEDICAL BENEFIT COMBINATIONS TO CLAIM COSTS FOR "BASE PLAN" WITH $11 UNIT VALUE (*k*), $500 DEDUCTIBLE, AND $10,000 MAXIMUM

(Claim Costs Calculated from *TSA*, XXI, 31-32, Table 1)

AGE	BENEFIT COMBINATION*											
	11/500/10,000 (Base Plan)		11/1,500/10,000		20/500/10,000		20/1,500/10,000		11/1,500/25,000		20/1,500/25,000	
	Claim Cost	Ratio	Claim Cost	Ratio	Claim Cost	Ratio	Claim Cost	Ratio	Claim Cost	Ratio	Claim Cost	Ratio
Men:												
25	$ 40.06	1.00	$ 13.89	0.35	$ 86.86	2.17	$ 36.19	0.90	$ 15.26	0.38	$ 46.54	1.16
40	68.46	1.00	31.30	0.46	138.14	2.02	75.24	1.10	34.42	0.50	90.30	1.32
55	145.81	1.00	77.77	0.53	283.15	1.94	175.58	1.20	84.55	0.58	204.59	1.40
70	307.90	1.00	189.52	0.62	573.41	1.86	456.40	1.48	204.89	0.67	470.83	1.53
Women:												
25	64.48	1.00	16.15	0.25	132.18	2.05	67.07	1.04	16.49	0.26	67.74	1.05
40	116.65	1.00	40.88	0.35	226.37	1.94	136.84	1.17	41.57	0.36	138.64	1.19
55	162.66	1.00	68.03	0.42	310.60	1.91	202.34	1.24	69.60	0.43	205.58	1.26
70	289.50	1.00	153.85	0.53	523.19	1.81	401.22	1.39	158.45	0.55	409.40	1.41
Factor from Table 18, Section A, of paper (either sex)	.....	1.00	.....	0.79	.....	2.00†	.....	1.58†	.....	1.01	.....	2.02†

* Benefit combination key: *k*-value/deductible/maximum; *k* of $11 assumed comparable to 1972 level of charges, *k* of $20 assumed comparable to projected 1978 level.

† Computed for projected 1978 level of charges equal to 200 percent of 1972 level.

a satisfactory valuation basis in a particular case. There is an increasing danger that the regulatory valuation of financial security plans of all kinds in the United States, life and pension as well as health, will be reduced to a rote application of some uniform arithmetic process and that actuarial judgment will be set aside entirely. This danger is increased by the false confidence that absolute regulatory standards tend to create in the minds of the public and government officials. Professional actuaries must do everything in their power to resist this trend, for in the long run it can only harm the American public.

CHARLES HABECK AND PHYLLIS A. DORAN:

We have studied the development of the 1974 Medical Expense Tables presented in the paper coauthored by Mr. Houghton and Mr. Wolf. For the most part, the techniques and approaches used in the construction of these tables appear to be orthodox, but we have included a number of comments relative to the authors' treatment of the data base. For convenience, we begin with our general conclusions; the details then follow.

1. *No minimum valuation standard should be adopted for any benefit that is subject to significant inflationary pressure.* The authors have recognized the problems in valuing such benefits, but they maintain that "the publication of a valuation table based on a static projection of experience is a useful although imperfect solution." We agree that the publication of such tables has historical value. It also is our belief that the adoption of a static minimum valuation standard for major medical benefits or hospital miscellaneous expense benefits can serve no practical regulatory purpose, no matter what labels and precautions are attached.
2. *One of the most obvious needs is for a reserving method that can reflect changes in morbidity that occur subsequent to policy issue.* The authors cite this need in their introduction, where they note that this subject deserves a paper of its own. A short description of our current practice may be of interest.

   To strengthen reserves for medicare supplement policies when the deductibles under medicare change, we have used the proportionate technique described by the authors, and for substantially the same reasons: convenience and relatively minor conservatism. More dramatic changes occur when major medical gross premiums increase 40 percent, 50 percent, or even more. Here our recommended practice is to increase aggregate reserves gradually, consistent with the revised morbidity basis. Theoretically, if such augmentation is funded from the increased premiums rather than from surplus, the process should not be considered "strengthening" for federal income tax purposes.

   Under our approach, no change is made in the original table of reserve factors; the modification involves a scheduled manual adjustment each year

to the aggregate value found on the original basis. The sequence of the adjustment factors reflects the pattern of reserve growth that would occur for a given block of business using the following elements to produce incremental reserve factors: (1) the additional net valuation premium related to the rate increases, (2) the attained ages at the time of the rate increases, and (3) the net level method rather than the preliminary term method. To our knowledge, this specific method is not used widely, although we have found several similar techniques. Our method appears to be most convenient where successive premium rate increases have been found necessary.

Along these lines, Illinois insurance department regulations call for additional reserves if rate increases are effected on policies under which the insurer has a limited right to nonrenew (Type C policies in rule 20.04). Such policies become "guaranteed renewable" when premiums are increased. The suggested method involves the use of attained ages and permits the use of a preliminary term period if desired. If carried out this way, the process cannot be considered strengthening.

3. *Further study should be undertaken, with particular reference to available population data, before valuation standards are established for cancer benefits or medicare supplement benefits.* We believe that data from the general population can provide additional insight into the patterns of morbidity for cancer hospitalizations and the utilization of hospital and medical services by persons covered under medicare. For instance, in their development of cancer cost factors, the authors distribute aggregate cancer hospital days by the number of claims in each age group. In effect, they have assigned the same average duration, regardless of age, to cancer hospital stays. Available population data generally do not support such an assumption. The evidence indicates that hospital stays for cancer tend to increase with age, with the most notable exception being hospitalization for leukemia.

   In establishing a standard for hospital utilization by persons over age 65, more use can be made of available experience data under medicare. For instance, reference to current continuance data reveals a substantial decrease in the average duration of hospital stays for this age group since the inception of medicare in 1965. Also, experience under medicare Part B (supplementary medical insurance) suggests a morbidity basis for reserving policies that provide supplemental comprehensive medical benefits, although inflationary pressures are also at work here.

4. *Scheduled benefits affected only by long-term trends in utilization are the only benefits for which a specific minimum reserve standard ought to be defined.* We support the establishment of minimum reserve standards for the following scheduled benefits: a daily hospital benefit, a flat benefit per hospital confinement, a scheduled surgical benefit, a flat maternity benefit, a standardized cancer benefit, and a medicare hospital supplement benefit.

   If maternity benefits are provided by means of an optional rider, we recommend that no offset be allowed against the nonmaternity benefits, that

is, negative reserve factors for a maternity rider should be ignored in the valuation. Utilization patterns can be expected to differ under these circumstances, since the premiums for such a rider typically are average premiums that do not vary by age.

In general, policy reserve values for level premium plans of insurance depend upon two aspects of the attained-age cost of insurance. The first is the relationship among succeeding cost factors as age increases, that is, the slope or pattern of the age-cost curve; the second is the relative magnitude of the cost factors. We now shall comment on these two aspects of the claim costs adopted for each benefit type included in the 1974 Medical Expense Tables.

Hospital Expense Benefits

A comparison for the daily hospital benefit of the values from the 1974 Medical Expense Tables with the current valuation standard points to the need for an updated minimum standard that reflects recent hospital experience. The authors have chosen to develop values based on the ultimate experience of individually underwritten lives for the five-year period 1968–72 as published in the *1972* and *1974 Reports.*

The ultimate hospital frequency levels demonstrate some variation over the two experience periods 1968–70 and 1971–72. Perhaps Messrs. Houghton and Wolf could discuss the considerations that led to their choice of data base, since the observed trend in hospital frequency levels has not been recognized.

A uniform adjustment by age has been employed to bring the data to an ultimate level. We are not certain that this method will produce claim costs that reflect accurately the patterns of ultimate experience by age. It is unfortunate that the intercompany experience has not been published on an ultimate basis, and the authors may have put themselves at a disadvantage by limiting themselves to data that have been published.

The table of adjustment factors included with the 1974 Medical Expense Tables for maximum benefit periods of other than 90 days has been carried over from the 1956 Intercompany Hospital Table. We believe that this table should be revised and simplified in view of recent hospital continuation experience data. The current factors were developed from experience that was available in the early 1950s. More recent data indicate that the percentage of hospital days that occur during stays of greater than 31 days has declined significantly since that time.

Since the 1970–72 group experience published in the *1974 Reports* pro-

vides continuation data only through the 70th day, we looked to other sources for an indication of current hospital continuance patterns. One such source consists of unpublished data from the 1974 Hospital Record Study, compiled by the Commission on Professional and Hospital Activities. Discharges by length of stay through 90 days and total days in excess of 90 are available for a representative sample of patients discharged from short-term hospitals in the United States.

From this study we developed adjustment factors for maximum benefit periods of less than 90 days and found the relationships among these factors to be very similar to those of the 1970–72 group experience in the range from 30 to 70 days. On the basis of a large block of group experience for 1976, which also showed a pattern similar to the 1974 Hospital Record Study data, these factors were projected for benefitperiods beyond 90 days.

The resulting factors for both males and females at selected maximum durations are as follows:

Maximum Duration	Factor
31 days	0.96
45 days	0.98
70–365 days	1.00

In view of these results we recommend the adoption of one set of adjustment factors to be applied to values for both males and females for maximum benefit periods of less than 90 days. Such factors should recognize the continuance patterns exhibited by recent hospital data. In this regard, an investigation of the effects of the current method used to adjust data to a 90-day benefit period as presented in the *1972 Reports*, page 170, Table 2, and the *1974 Reports*, page 70, Table 2, is enlightening.

Although we have found the effects on claim costs of variations in hospital benefit periods in excess of 31 days to be relatively minor, the effects of elimination periods are significant, varying by age. On the basis of the 1974 Hospital Record Study data, we have developed relative costs by age and sex for hospital stays where there is a waiting period for either accident or sickness or both. A paper dealing with this subject is currently in preparation.

The treatment of the miscellaneous hospital expense benefit raises several questions. We have expressed reservations concerning the feasibility of any minimum valuation standard for benefits subject to the heavy inflationary increases that now affect hospital miscellaneous expenses. The authors have recognized that the factors for adjustment to

maximum benefits other than $200 are applicable only temporarily. They suggest updating these factors every two or three years.

Our own projections indicate that the factors representing the January 1, 1977, level of charges are already out of date. In order to reflect current cost trends properly, we believe that such factors require annual adjustment. It would be unreasonable to expect regulatory officials to promulgate meaningful minimum standards under these circumstances, especially if a uniform basis by state is desired.

The authors describe the method by which average claim amounts for the $200 maximum miscellaneous hospital benefit were projected from the 1968–70 and 1971–72 experience periods to January 1, 1977. However, their description does not provide enough information to allow us to reproduce the aggregate trend factors of 23 percent and 14 percent.

One of the problems in dealing with trends is illustrated in the authors' development of average claim amounts for a $200 maximum benefit as finally adopted for the 1974 Medical Expense Tables. The use of aggregate trends with no variation by age produced substantially lower average claim amounts at age 17 than at the higher ages. The 1968–70 experience presented in the *1972 Reports* indicates that such a pattern did exist during that period. However, a comparison with the *1974 Reports* supports the application of a higher trend at the younger ages. The result is less variation in average claim amounts by age at the January 1, 1977, projected level.

The average claim amounts adopted for the 1974 Medical Expense Tables show little variation beyond age 47, although experience indicates that average claims generally increase with age beyond this point. The cost curve for this $200 maximum benefit is therefore flatter by age than the curve that would apply to a higher maximum benefit. The factors that have been provided for modifying values for other maximum benefits do not recognize this change in slope and therefore produce an unsatisfactory minimum standard for miscellaneous hospital expense benefits exceeding $200.

Proper valuation of a benefit such as this requires a set of relative cost factors that steepen as the maximum benefit increases and to which could be applied a conversion factor that best represents current cost levels. Use of the ultimate morbidity level assumed in the gross premium calculation for this benefit probably would satisfy the requirements of this reserving approach.

Surgical Expense Benefit

The crude net annual claim costs for a $100 maximum surgical benefit adopted for the 1974 Medical Expense Tables represent a weighted aver-

age of the crude values presented in the *1972* and *1974 Reports*, after adjustment to an ultimate basis. Although the ultimate claim costs for the 1971–72 experience period show an average increase of about 15 percent over the 1968–70 experience, this observed trend has not been recognized in the development of values for the 1974 Medical Expense Tables. As we have suggested in the discussion of hospital expense benefits, perhaps the authors could comment on their rationale for the development of the crude claim cost values for surgical benefits.

Major Medical Expense Benefit

Our opinion is that a static minimum valuation standard for major medical benefits would not be practical. Use of the ultimate morbidity assumption underlying the gross premium structure would be more meaningful. Instead of discussing the authors' presentation, we believe that a description of our own methods for pricing (and hence reserving for) major medical policies would contribute to the solution of the problem.

The pricing of major medical benefits is a complex process. Many contractual variables must be recognized. Deductibles, coinsurance percentages, and maximum amounts gradually have drifted away from their earlier meanings. To handle this complexity, we divide the morbidity assumption into four components: (1) an average claim cost factor, (2) an age-cost curve, (3) a scale of policy-year factors that adjust for underwriting practices, and (4) an overall underwriting adjustment factor that can include a secular trend. We shall discuss only the first two components and then describe how we derived an age-cost curve for major medical benefits with a $500 deductible.

The average claim cost factor is calculated by use of a system that recognizes the most important variables that affect cost. The starting point in this system is a basic table of cost factors by benefit type. Cost estimates for a $0 deductible are developed for each benefit by reference to group and individual insured data, population statistics, and various unpublished experiences. Convolution techniques are used to estimate cost factors for various benefit packages, where the package is subject to a range of deductible amounts from $50 to $10,000. These tabular factors move through the rating system after an initial adjustment for the applicable coinsurance provision. About a dozen steps later the average claim cost factor emerges, having been modified for geographical area, internal benefit limits in that area, application of the deductible, benefit period, extended coverage of dependent children, overall maximum amount, and any other contract features that affect cost.

The average claim cost factor (representing the cost for male age 47) is applied to an age-cost curve to produce attained-age claim cost factors separately for male and female lives. These same factors need only be multiplied by the product of the ultimate selection, underwriting, and trend factors to make them useful as a valuation basis.

The age-cost curve represents the pattern of morbidity by age that appears to correspond best with the benefit package being priced. For major medical benefits we now use three such curves differing in steepness according to deductible level, for basic hospital-medical coverages we use different curves for each benefit and for medicare supplement policies we have four separate curves. This analytical approach allows for a more convenient comparison of morbidity patterns for reasonableness and consistency among a wide range of benefit types.

To produce our current age-cost curve for the $500 deductible major medical benefits, we used exposure and claims data from Tables 21, 25, and 27 of the *1972 Reports* and from Tables 21, 25, 27, and 31 of the *1974 Reports*. Our goal was not only to maximize the experience base but also to include data where the deductible was variable and where there was a limit on room and board, since we commonly recommend these two plan features.

Our method was to combine all the exposure and claims in these seven tables and then develop an average claim cost for each age-sex cell. Next, we selected the value for male age 47 as our base and divided all other values by it. We ignored all data for lives over age 65; our age-cost curve stops with age 64. The resulting scales for male and female were then graphed, with some arbitrary adjustments near the endpoints. A graduation emphasizing fit was carried out. The final values for quinquennial attained ages are shown in the following table:

$500 DEDUCTIBLE MAJOR MEDICAL

AGE-COST FACTORS*

Attained Age	Male	Female	Attained Age	Male	Female
22.....	0.423	0.545	47.....	1.000	1.383
27.....	0.365	0.598	52.....	1.595	1.679
32.....	0.393	0.639	57.....	2.528	2.276
37.....	0.640	0.773	62.....	3.435	2.765
42.....	0.853	1.106			

* Ratio of claim cost at attained age indicated to claim cost at male age 47.

For several reasons we made no preliminary adjustments to the published data. First, the method gives considerable weight to recent experience.

Second, an appropriate trend factor would have been difficult to determine because of the price freeze of 1971 and the controls imposed thereafter. Third, since the process would have to be repeated from time to time, it was not worth the effort to include speculative refinements. Our graduation emphasized fit to respond to the trend toward yearly renewable term pricing and to support rate differentials by sex.

The procedures that have been outlined may suggest a method of defining a dynamic minimum valuation standard for major medical. We continue to prefer the "tailor-made" basis that underlies the gross premium structure itself.

Cancer Expense Benefit

Our analysis of the methods used and the results obtained for cancer benefits can be described best as inconclusive. We attempted to repeat the procedures described by the authors in finding the ratio of cancer hospital utilization to all-cause hospital utilization. We noted that the method assumes, in step 5, that the average duration of hospital stays is the same for all ages, since total cancer hospital days are distributed according to the number of cases in each age group.

In step 5, we obtained an average duration of 26.8 days per case. On the other hand, using population statistics for 1975,[1] we developed an average hospital duration of only 12.2 days for malignant neoplasms. Although these statistics exclude patients who die and certain others, such as those with stays over 100 days, it cannot be assumed that their inclusion would double the average length of stay. The higher average duration that emerges as a by-product of step 5 may not be meaningful, since the ratios of cancer to all-cause hospital utilization produced by the Houghton-Wolf method do not differ much from the corresponding ratios developed from the population source, as shown in the table at the top of page 90.

The loadings for adverse selection in step 7 of the authors' method appear to be based more on judgment than on actual experience. Before adopting a reserve standard with loadings of this magnitude, the actual experience of several of the larger insurers of this type of benefit should be studied. Especially important in such an analysis is the method of marketing, for example, whether policies are sold individually through agents or through direct mail, or whether they are sold to groups and associations by means of wholesale or "cluster" selling. Until such studies can be made, a basic question will remain as to the differences to be expected between insured lives and the general population.

[1] *Length of Stay in PAS Hospitals, by Diagnosis, United States, 1975* (Ann Arbor, Mich.: Commission on Professional and Hospital Activities, 1976).

CANCER HOSPITALIZATIONS
(MALE AND FEMALE COMBINED)

Age Group	Average Stay (Days)	Ratio of Cancer Days to All-Cause Days	
		Population Data*	Houghton-Wolf Method†
0–19	8.7	0.0100	0.0090
20–34	7.6	0.0179	0.0219
35–49	10.2	0.0473	0.0595
50–64	12.0	0.1003	0.1257
65 and over	13.7	0.1097	0.1203
All	12.2	0.0721	0.0820

* Using *Length of Stay in PAS Hospitals, by Diagnosis, United States, 1975* (Ann Arbor, Mich.: Commission on Professional and Hospital Activities, 1976).

† Using *Third National Cancer Survey, Advanced Three-Year Report*, DHEW Publication No. (NIH) 74-637 (Bethesda, Md.: National Cancer Institute, 1974).

If the proposed valuation basis for cancer benefits is adopted as a minimum standard without further confirmation, the following results appear likely:

1. The need for such reserves will be established clearly, despite the fact that most cancer policies are sold with one average premium that does not vary by age, or with only two age groupings for premiums—under age 65, and age 65 and over.
2. For many companies the minimum standard proposed in the Houghton-Wolf table will represent an increase in additional reserves. For a few companies it will produce lower aggregate reserves, especially where, on the current basis, the company has assumed that the average claim amount will increase with increasing age.
3. Once adopted, the standard is not likely to be reviewed or changed for many years.
4. The pressure to gather and publish additional experience data will subside.
5. If the loadings that have been applied to population data prove to be excessive, as we are suggesting may be the case, at least two undesirable consequences can be expected from the regulatory point of view. First, additional reserves will be understated; second, there will be a temptation to use this standard for gross premium calculations or for estimating expected loss ratios.

As an example of this last point, we use a loading of 20 percent to represent the excess cost to be expected for insured lives as compared with the general population, and we had a premium filing rejected with the following comments (the estimated loss ratio was 48 percent): "The basic data [used here] is primarily group health insurance data. It seems unlike-

ly that claim costs under individual policies would be noticeably higher than such data from either group coverage or general population data. Probably the selection exercised by the company is at least as effective as the antiselection exercised by the policyholder."

The Houghton-Wolf cancer tables include an aggregate loading of 30 percent, but it is not applied uniformly. Had we used this same pattern of loadings, we probably could have met the 50 percent loss ratio requirement in the situation described because of the young age distribution—30 percent of the exposure was at ages under 40, 50 percent at ages 40–59, and the rest at ages 60 and over. A final question: do the authors anticipate that their claim cost basis will be used in gross premium calculations?

Although we are unable to endorse the 1974 Cancer Tables without reservation as a valuation standard in their present form, we hope that confirmation (or modification) will be possible soon, either based on meaningful insured data, if such is made available, or else based on a more complete investigation of population experience.

Medicare Supplementary Expense Benefits

Participation in the medicare program among persons over age 65 has grown to be almost universal. The Office of Research and Statistics of the Social Security Administration has published a number of studies in the past few years that present utilization and cost data for both the health insurance (HI) and the supplementary medical insurance (SMI) programs. Therefore, it is surprising to see only limited reference by the authors to statistics from this block of data.

Medicare supplement policies are common, and insurance departments are concerned about minimum benefits and minimum loss ratios for such plans. The trend is toward requiring comprehensive hospital and medical benefits, and in such cases the gross premiums and additional reserves can be substantial. Hence, the morbidity basis for these benefits should be established with care.

Part A (HI) of medicare requires a deductible amount per "spell of illness." If the interval between confinements in a hospital or skilled nursing facility exceeds 60 days, a new spell of illness begins and a new deductible is required under Part A. The medicare hospital supplement policy usually provides for reimbursement of the deductible amount and associated coinsurance amounts for each spell of illness. To enable proper pricing and reserving, knowledge of the distribution of reentries to the hospital by number of days elapsed between stays is essential.

For various reasons we found it difficult to make direct comparisons between our morbidity basis and that contained in the 1974 Medical

Expense Tables, especially for the deferred confinement benefits. However, we have been able to rationalize the tabular claim cost factor for the initial hospital deductible amount. Our morbidity basis was derived by adjusting the reported medicare hospitalization frequency to recognize the savings due to multiple hospitalizations in a single spell of illness. At attained age 72 our current claim cost value for the initial deductible is 3 percent higher than that in the 1974 Medical Expense Tables.

In contrast, we found that the tabular claim cost factors for the deferred hospital and skilled nursing facility benefit segments are over three times our own cost estimates for these items. It appears impossible to confirm either basis without developing a hospital continuance table that treats reentries within 60 days as continuations rather than new starts. Our current assumption of the distribution of hospital days for persons over age 65 is as follows:

Interval (Days)	Proportion of Total Days	Interval (Days)	Proportion of Total Days
1–7	0.4727	61–90	0.0136
8–30	0.4141	91–150	0.0143
31–60	0.0617	151–365	0.0236

Note that this distribution, which has been developed from population data, allocates about 95 percent of the total hospital days to the first 60 days of confinement. However, no attempt has been made to adjust the distribution for multiple confinements.

As pointed out by the authors, reserve values for benefits that supplement medicare Part B (SMI) can be developed from the 1974 Medical Expense Tables if such benefits relate to a hospital confinement. For instance, if the $60 Part B calendar-year deductible is reimbursed only where confinement is involved, 60 percent of the $100 per hospital confinement reserve factors could be used to value this benefit. This basis could be conservative where the intent is to pay the benefit only once in a calendar year.

The authors have not indicated how to value comprehensive benefits that supplement medicare Part B both in and out of the hospital. Since such benefits are in the major medical category, perhaps reference to the major medical net claim cost values in Table B for ages 65 and over may be helpful. Is there any way that these values, labeled "Nonduplication of Medicare Benefits," can be used to value a Part B supplement?

Summary

A dynamic reserving method appears necessary if a meaningful minimum valuation standard is to be adopted for health insurance benefits subject to substantial inflationary pressure. Such a method would reflect the morbidity assumptions underlying the gross premiums. Whatever method is developed, its principles should coordinate with those contained in any premium increase or reserve-strengthening guidelines that may be promulgated by the NAIC.

Proper valuation of health insurance benefits is a complex and demanding activity. We commend the authors of this paper for having the courage to accept the challenge and for making use of their knowledge and experience to achieve their goal in so admirable a fashion.

Acknowledgment

Basic data referred to in this discussion were supplied in part by the Commission on Professional and Hospital Activities (CPHA), Ann Arbor, Michigan. In these data, the identities of individual hospitals were not revealed in any way. Any analysis, interpretation, or conclusion based on these data is solely that of the users, and CPHA specifically disclaims responsibility for any such analysis, interpretation, or conclusion.

FRANCIS T. O'GRADY:

This paper is welcome for a special reason to those of us who serve on the Society's Committees on Mortality and Morbidity Experience Studies—it demonstrates a valuable application of the experience data we collect, compile, and report. In this case, Messrs. Houghton and Wolf have used the experience under individually underwritten medical expense policies published in the *Reports* as their main source for developing tables that are intended to be appropriate bases for the calculation of statutory reserves for such policies.

The authors used the intercompany experience for the years 1968 to 1972 from the *1972* and *1974 Reports* as their main source of basic data. The Committee on Health Insurance, of which I am chairman, has collected and compiled the experience for the years 1973 and 1974. The report on this experience appeared in the *1977 Reports*.

I have reviewed the 1973–74 experience to see what effect, if any, its availability would have had on the findings the authors present in their paper. My conclusion is that, while there might have been some minor changes in the numerical results the authors published, their approach and conclusions are supported by the 1973–74 experience.

In the section of the paper entitled "Reasons for the Development of

New Tables," frequent reference is made to ways in which the experience under hospital and surgical benefits during the 1968–72 period differed from the values of the 1956 Intercompany Hospital and Surgical Tables. The 1973–74 experience confirms these findings.

The authors discuss several problems regarding the continued use of the 1956 tables. The first problem relates to the frequency of hospital confinement, and the authors report that in the male experience for 1968–72 such frequencies continued to increase rapidly after age 65. The 1973–74 intercompany experience compared with the 1956 Intercompany Hospital Table (IHT) for males age 65 and over is as follows:

FREQUENCY OF HOSPITALIZATION—MALES

Attained Age	Ratio of 1973–74 Intercompany Experience to 1956 IHT
65–69	1.34
70–74	1.69
75–79	1.87

The second and third problems concern the slope and level of claim costs for surgical benefits. The authors refer to (1) the increasing slope for recent male experience as compared with the 1956 Intercompany Surgical Table (IST), (2) the similarity of the slope of the female experience and the 1956 IST except after age 65, and (3) the generally higher level of claim costs for both sexes compared with the current valuation standard. The 1973–74 intercompany experience claim costs compared with the 1956 IST are as follows:

CLAIM COSTS PER $100 OF MAXIMUM SURGICAL BENEFIT

Attained Age	Ratio of 1973–74 Intercompany Experience to 1956 IST		Attained Age	Ratio of 1973–74 Intercompany Experience to 1956 IST	
	Male	Female		Male	Female
15–19	1.72	1.12	50–54	1.37	1.25
20–24	0.93	0.85	55–59	1.46	1.22
25–29	0.89	1.00	60–64	1.53	1.23
30–34	1.07	1.22	65–69	2.04	1.55
35–39	1.17	1.23	70–74	2.27	1.61
40–44	1.26	1.30	75–79	2.17	1.77
45–49	1.32	1.30			

The fourth problem relates to the level of the claim costs for miscellaneous hospital benefits. The 1973–74 intercompany experience claim costs for miscellaneous hospital benefits compared with those of the 1956 IHT are as follows:

CLAIM COSTS FOR $200 MAXIMUM MISCELLANEOUS HOSPITAL EXPENSE BENEFIT

Attained Age	Ratio of 1973–74 Intercompany Experience to 1956 IHT		Attained Age	Ratio of 1973–74 Intercompany Experience to 1956 IHT	
	Male	Female		Male	Female
15–19	3.56	3.12	50–54	1.87	1.75
20–24	1.63	2.12	55–59	1.84	1.43
25–29	1.54	2.18	60–64	1.62	1.25
30–34	1.80	2.30	65–69	1.79	1.47
35–39	1.89	2.29	70–74	2.14	1.67
40–44	1.96	2.20	75–79	2.30	1.79
45–49	1.92	2.02			

Several examples are given in the paper of the development of crude values for a male life at a specified attained age combining data from the *1972* and *1974 Reports*. Comparable crude values for the 1973–74 experience data appearing in the *1977 Reports* have been developed, and the effect of weighting these values with those of the two prior experience periods is shown in the tables on pages 96–97.

The statement of actuarial opinion accompanying the annual statement requires an opinion from the actuary signing the statement that the amounts carried in the balance sheet on account of the various actuarial items, including accident and health reserves, make good and sufficient provision for all unmatured obligations of the company guaranteed under the terms of its policies. This requirement would seem to make it incumbent on the actuarial profession to review reserve standards periodically. Such a review should include a determination whether the actual experience has changed sufficiently, either in the aggregate or in any significant component, to warrant consideration of a recommendation to change the valuation standard. This paper by Messrs. Houghton and Wolf has done this for individual medical expense coverages in a complete and expert fashion and is a valuable contribution to actuarial literature.

FREQUENCY OF HOSPITALIZATION
MALE, ATTAINED AGE 37

Source	Crude Frequency of Hospitalization for All Durations (1)	Ratio of Experience in All Durations to Experience in Durations 3 and Later (All Ages Combined) (2)	Crude Frequency of Hospitalization for Durations 3 and Later [(1)/(2)] (3)
TSA, 1977 Reports....	0.0915	0.91	0.1005

Combined crude frequency rate for durations 3 and later $= (0.553)(0.0841) + (0.258)(0.0953) + (0.189)(0.1005) = 0.0901$. This value compares with the value of 0.0877 shown in the paper.

AVERAGE PERIOD OF HOSPITALIZATION
MALE, ATTAINED AGE 37

Source	Crude Average Period of Hospitalization for All Durations Combined (Days) (1)	Ratio of Experience in All Durations to Experience in Durations 3 and Later (All Ages Combined) (2)	Crude Average Period of Hospitalization for Durations 3 and Later [(1)/(2)] (3)
TSA, 1977 Reports....	7.35	0.99	7.42

Combined crude average for durations 3 and later $= (0.553)(7.29) + (0.258)(7.37) + (0.189)(7.42) = 7.34$ days. This compares with the value of 7.32 days shown in the paper.

$200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT
MALE, ATTAINED AGE 32

Source	Crude Average Claim, Projected to January 1, 1977, Durations 3 and Later	Number of Claims
TSA, 1977 Reports.....	$180.60	716

Combined crude average claim $= [(\$174.43)(2{,}950) + (\$177.13)(1{,}373) + (\$180.60)(716)]/(2{,}950 + 1{,}373 + 716) = \$176.04$. This compares with the value of $175.29 shown in the paper.

DEVELOPMENT OF MATERNITY FREQUENCIES FOR DURATIONS 3 AND LATER, ATTAINED AGE 27

Source	Duration 3			Duration 4		
	No. of Claims (1)	Claim Frequency (2)	Lives Exposed [(1)/(2)] (3)	No. of Claims (4)	Claim Frequency (5)	Lives Exposed [(4)/(5)] (6)
TSA, 1977 Reports..	871	0.211	4,128	646	0.182	3,549

Source	Durations 5 and Later			Durations 3 and Later		
	No. of Claims (7)	Claim Frequency (8)	Lives Exposed [(7)/(8)] (9)	No. of Claims [(1)+(4)+(7)] (10)	Lives Exposed [(3)+(6)+(9)] (11)	Claim Frequency [(10)/(11)] (12)
TSA, 1977 Reports..	1,487	0.147	10,116	3,004	17,793	0.169

The claim frequency of 0.169 from the *1977 Reports* was combined with the claim frequencies from the *1972* and *1974 Reports* using the method described in the paper. The aggregate number of maternity claims from the *1977 Reports* was 12,694, and this produced weights of 0.570, 0.312, and 0.118 for the *1972*, *1974*, and *1977 Reports*, respectively. Thus, the crude frequency for attained age 27 is (0.570)(0.192) + (0.312)(0.173) + (0.118)(0.169) = 0.183. This compares with the graduated value of 0.185 shown in Table 12 of the paper.

LEE A. ZINZOW:

This paper and the 1974 Medical Expense Tables certainly represent significant contributions to actuarial literature. It is hoped that the following remarks will add further value to this fine effort. Except for a few brief preliminary comments, these remarks relate to the valuation of cancer benefits, a topic that this discussant has had occasion to research rather extensively.

The authors note that the 1978 projected level of major medical expenses was derived by projecting 1972 claim costs forward at a 12.2 percent annual secular trend rate and that this factor is one of convenience rather than one based on a detailed trend study. Recent experience suggests that this rate may be low. One large insurer has reported an average annual inflationary factor of 14.5 percent for such services over the

period 1972–76, with the last year of this period, 1975–76, showing an increase of 17.0 percent. Most companies appear to be using projection factors in the range of 14–18 percent in their current rating formulas. The Board of Trustees of the Federal Old-Age and Survivors Insurance Trust Fund, Disability Insurance Trust Fund, Hospital Insurance Trust Fund, and Supplementary Medical Insurance Trust Fund, in their 1977 Annual Reports, stated that under "most likely" assumptions hospital costs are expected to increase by about 15 percent annually for the next five years and by 10 percent annually for the ensuing ten years.

Because premiums and reserves vary directly with the inflation rate, it certainly is important to monitor such trends closely in order to determine whether sufficient margins are available to ensure adequate coverage of policy liabilities. Of course, the use of a table such as that proposed, which assumes no future secular increase in claim costs, may create serious reserve deficiencies if such a trend is to be expected and if the company fails to anticipate future rate increases on both new and existing issues.

The development of the cancer claim costs is intriguing. Certain assumptions, implicit in the logic of the approach, are worthy of closer examination. The authors employ a clever, although somewhat circuitous, method to estimate ratios of cancer hospital days to all-cause hospital days. These ratios then are multiplied by all-cause claim costs to derive expected cancer claim costs. Apart from the approximate nature of the first calculation, it would seem questionable whether cancer claim costs should be determined by multiplying all-cause costs by hospital utilization ratios. This procedure seems to imply that (1) claim costs are directly proportional to length of stay and (2) the nature of the admission has no bearing on the expected level of costs, except to the extent that the length of stay might vary, thereby affecting total cost. One would expect that the nature of the admission would affect radically the type and cost of treatment to be expected, regardless of the expected length of stay, and that treatments for cancer might be relatively more costly than treatments for other ailments. One also might hypothesize that in general the claim cost per hospital day would vary inversely with length of stay. Since cancer patients may have longer than average stays compared with the total hospital population, the cost per day for cancer may be expected to be lower than average if equally expensive treatment methods are used as for other disabilities. This factor may offset partially or wholly the higher claim costs expected from expensive cancer treatment procedures. It may be unwise, however, simply to assume

that these factors are offsetting and that it therefore is accurate to equate cancer costs per cancer hospital day to total costs per all-cause hospital day.

The approach we have adopted in our company is to develop from industry experience a table of average cancer claim amounts by attained age, separately for each type of cancer benefit. Then the claim amounts are multiplied by cancer incidence rates, also developed from industry experience and varying by attained age. For this purpose "incidence rate" is defined as the frequency of hospitalization for cancer. Thus, two separate hospitalizations for the same person and disease are counted twice even though only one actual incidence of cancer has occurred. This definition is one of convenience, since claim amounts may be related more easily to a single hospital stay and no estimate need be made of the average number of stays per diagnosed cancer case.

The incidence rates are based on the experience of one larger insurer, so several alternative sources were used to perform independent checks on these calculations. From the 1974 Professional Activity Study, ratios of cancer admissions to total hospital admissions were derived. These ratios were applied to all-cause hospitalization frequencies obtained from the 1971–72 intercompany experience published in the *1974 Reports*. These results were felt to be understated because of the exclusion from the Professional Activity Study data of patients who were transferred to other hospitals, hospitalized over 100 days, or teminally ill. Incidence rates also were derived from United States population data, as reported in the 1958 United States Public Health Monograph No. 56 (based on 1947 experience) and from the National Cancer Institute study *Third National Cancer Survey: Incidence Data, 1969–71* referred to by the authors. The data from these sources were adjusted by approximate factors that recognize geographical influences, underreporting of claims, and the trend in claim costs since the periods on which the studies were based. Since all these procedures resulted in very similar and consistent scales of incidence rates, the scale finally adopted was that based on actual company experience.

In order that any given package of cancer benefits could be analyzed and priced appropriately, average expected claim amounts based on insured benefits were developed separately for each type of cancer benefit. All claim amounts were subdivided by attained age at claim.

The daily hospital room and board benefit defined in the policy should be multiplied by the average number of days confined. The 1974 Professional Activity Study data were used to ascertain that the expected average stay is 6.5 days if claim continuance for only the first seven days

of hospitalization is considered. Where cancer benefits reduce after the first week, the total claim amount is the sum of (1) the product of the reduced daily benefit and the total expected stay and (2) 6.5 times the amount of reduction in daily benefit.

To obtain surgical claim amounts, the amount payable for each item in the surgical schedule for the policy should be multiplied by the number of claims expected according to a typical claim distribution. The result then should be divided by the sum of similar products using the standard scheduled amounts. This yields a composite weighted ratio for all benefits at each age. To derive the expected claim amount for the age, multiply this ratio by the average claim amount actually paid under the standard schedule. This technique is not theoretically precise, especially where the two benefit schedules being compared are extremely dissimilar, but in most cases sufficiently accurate results can be expected. Since the surgical claim amount ultimately will be added to all other claim amounts and multiplied by the incidence rate, it is important to know the expected number of surgical operations per admission. Lacking data in this regard, a one-to-one correspondence might be assumed, although this is probably very conservative. Perhaps other discussants can offer data or suggestions as to how the number of surgical operations might be related to the number of hospital admissions.

Relatively small benefits, such as those for anesthesia, blood and plasma, and ambulance charges, can be estimated either by using average claim amounts for insured lives, taken directly from industry experience, or by adjusting such amounts by the ratio of the maximum benefits under the policy in question to the maximum benefits under the policies for which the claim amounts are known. Alternatively, anesthesia benefits can be added to surgical claim costs and included in those calculations in the manner just described. To my knowledge, there is no experience available on expected claims for benefits providing reimbursement for travel to health care facilities. Again, perhaps other discussants can suggest how such costs may be estimated.

Payments for drugs and medicine are commonly expressed as a percentage of benefits for hospital confinement, so claim amounts may be derived readily by multiplying this percentage by the hospital claim amounts previously determined. Benefits for nurses and attending physicians are usually expressed in terms of dollar amounts per day of hospital confinement. The expected payment for these benefits may be calculated by multiplying the daily benefit by the average length of stay derived in obtaining hospital room and board benefits.

When claim amounts for these benefits have been determined, an

increase of 10 percent for radiotherapy and 3 percent for extended care, as suggested by the authors, seems reasonably conservative in most cases.

After the claim amounts have been multiplied by the incidence rates to obtain annual claim costs, it is necessary to adjust for underreporting of claims if the underlying data are based on noninsured groups, and to provide some margin for adverse deviations, antiselection, and perhaps inflation. The adjustment factors assumed by the authors, which grade from 200 percent at age 27 to 100 percent at 77, should be examined to determine whether they are appropriate.

Since the scale of adjustments is somewhat arbitrary, it seems that the authors concluded that a decreasing percentage adjustment would be desirable because it would result in a relatively constant absolute margin and thus provide for deviations of similar magnitude at all ages. A constant percentage margin, on the other hand, would provide an absolute dollar margin varying directly with age. A decreasing scale of margins, when applied to an increasing scale of basic claim costs, produces a flatter rate schedule and higher premiums at younger ages than a level scale of percentage adjustments. This would aid companies that are attempting to justify rather flat premium scales, since such scales otherwise might be viewed as charging young lives with a disproportionate share of expense loading.

Is it reasonable, however, to assume that a constant absolute contingency margin is more appropriate than a constant percentage margin? Since a large part of the margin should provide for expected undiagnosed claims in the noninsured population, should we expect the percentage of unreported claims to vary by age? This problem is explored in some detail on pages 7 and 8 of United States Public Health Monograph No. 56, *Morbidity from Cancer in the United States*, published by the Public Health Service. According to this source, necropsy experience has shown that the number of deaths assigned to cancer in official vital statistics should be increased by about 20 percent to recognize errors in diagnosis and incorrect reporting. (This percentage understatement in deaths probably corresponds closely to the understatement in hospital incidence rates and cancer claim costs and would seem to correlate closely with the aggregate antiselection margins of 27 and 33 percent for males and females, respectively, developed by the authors.) Such errors may be attributed to faulty diagnostic procedures, failure to obtain medical care, and clinically quiescent or occult neoplasms; these are especially common among older lives. It is probably fair to assume that most of these cancers would be reported correctly among an insured population, which

leads us to believe that the percentage increase in claim costs is likely to remain level or to increase with advancing age.

In addition to providing an allowance for undiagnosed claims in the general population, margins are necessary to account for the following factors:

1. Inflation in claim amounts not controlled by policy limits.
2. Antiselection among the insured population (for instance, individuals with a family history of cancer might be more inclined to buy cancer policies, and it is likely that the average insured will be a poorer than average risk in view of the absence of any real underwriting for most cancer policies).
3. An increasing secular trend in incidence rates and claim costs, to the extent that this is not specifically recognized in the development of the gross premiums.

None of these items seems to call for a pattern of margins that decrease substantially with advancing age. Historically, the secular percentage increase in incidence rates has varied somewhat by age, but there seems to be no significant or discernible pattern to the magnitude of such increases.

Perhaps the most significant point bearing on the appropriateness of any scale of margins is the effect of resulting claim costs on the level of reserves. Obviously, a constant percentage margin will produce reserves that generally are higher than those resulting from a comparable scale of decreasing percentage margins. A conservative approach to reserve calculation seems especially advisable in view of some evidence that cancer claim costs are select in the early durations, implying that higher reserves would be developed if a more theoretically precise select and ultimate basis were adopted in lieu of an aggregate table approach. Finally, a higher reserve basis will contribute to higher incurred loss ratios and perhaps will be helpful in justifying any future rate increases.

Finally, while a level percentage loading would appear to produce somewhat lower net premiums at younger ages than a decreasing scale, it should be noted that failure to incorporate lapse assumptions into the calculation of net premiums will cause the higher claim costs at the older ages to be given disproportionate weight, resulting in artificially high net premiums except for those policies that provide an appropriate level of cash values upon surrender. Therefore, the additional conservatism afforded by the choice of a scale of claim costs that is higher in the early years seems unnecessary.

A comparison of net premiums and reserves under various assumptions may be helpful in illustrating the points that have been outlined. Column 1 of Table 1 of this discussion presents values for males and females

TABLE 1

STANDARD CANCER EXPENSE BENEFIT—LIFETIME PLAN
NET ANNUAL PREMIUMS AND MIDTERMINAL RESERVE FACTORS
TWO-YEAR PRELIMINARY TERM BASIS, MALES AND FEMALES COMBINED
1958 CSO MORTALITY TABLE, 3 PERCENT INTEREST

	Values from Authors' Table 23, Males and Females Combined (1)	Values Developed by Methods Described in Discussion Adjusted by Authors' Antiselection Factors (2)	Values Developed by Methods Described in Discussion without Adjustment by Authors' Antiselection Factors (3)	Values Developed as in (3) but Projecting 1.8% Annual Claim Cost Inflation (4)
	Age 25			
Net annual premium...	$ 12.53	$ 7.64	$ 6.09	$ 10.36
Midterminal reserve:				
Policy year 4.....	15.64	16.74	15.46	31.33
8.....	58.72	61.94	58.10	119.59
13.....	113.87	118.27	113.50	238.87
18.....	165.81	171.91	169.37	365.75
25.....	220.34	231.58	239.47	542.49
35.....	253.50	257.90	294.63	735.14
	Age 35			
Net annual premium...	$ 17.60	$ 13.26	$ 11.07	$ 16.65
Midterminal reserve:				
Policy year 4.....	18.83	19.27	19.36	35.59
8.....	66.98	69.17	71.02	133.25
13.....	118.06	124.08	132.00	256.30
18.....	157.22	169.65	187.57	377.45
25.....	188.42	190.25	229.86	501.27
35.....	184.94	205.43	273.32	656.68
	Age 45			
Net annual premium...	$ 23.98	$ 20.83	$ 18.65	$ 25.38
Midterminal reserve:				
Policy year 4.....	16.79	18.12	21.05	36.86
8.....	57.36	64.82	76.53	136.18
13.....	95.78	99.66	126.80	240.28
18.....	118.36	115.24	159.85	323.82
25.....	127.70	145.35	209.68	446.44
35.....	116.71	145.62	210.43	505.56

TABLE 1—*Continued*

	Values from Authors' Table 23, Males and Females Combined (1)	Values Developed by Methods Described in Discussion Adjusted by Authors' Antiselection Factors (2)	Values Developed by Methods Described in Discussion without Adjustment by Authors' Antiselection Factors (3)	Values Developed as in (3) but Projecting 1.8% Annual Claim Cost Inflation (4)
	Age 55			
Net annual premium...	$ 30.47	$ 28.95	$ 28.42	$ 35.84
Midterminal reserve:				
Policy year 4.....	12.46	7.95	14.65	28.74
8.....	39.35	32.59	55.96	107.77
13.....	83.57	75.79	110.80	210.38
18.....	72.73	93.12	148.77	291.81
25.....	81.40	104.46	158.69	341.70
35.....	68.72	101.73	142.03	347.52
	Age 65			
Net annual premium...	$ 35.87	$ 35.59	$ 39.34	$ 47.10
Midterminal reserve:				
Policy year 4.....	7.11	13.20	20.82	33.65
8.....	24.61	40.13	63.74	109.16
13.....	41.46	58.55	90.21	169.48
18.....	49.60	80.02	110.69	219.45
25.....	44.53	78.66	98.64	231.97
35.....	−1.19	11.36	15.16	41.96

combined derived from the authors' Table 23. Column 2 was derived by first calculating claim costs as described in this discussion. If it is correct to assume that these costs overstate those developed from the general population by 20 percent at all ages, costs comparable to the authors' costs may be derived by dividing the calculated claim costs for an insured population by 1.2 and then multiplying the results by the antiselection factors suggested by the authors. This results in the values shown in column 2.

Generally, net premiums and reserves in columns 1 and 2 are in surprisingly close agreement, except for certain reserves at some of the later durations at the older ages, which are significantly higher under the latter approach. This consistency lends support to the correctness of the

underlying claim costs developed by the authors and to the contention that insured claim costs may exceed noninsured costs by 20 percent at all ages.

Column 3 is comparable to column 2, except that claim costs calculated according to the methods outlined in this discussion are used directly without being adjusted by the antiselection factors used in column 2. These costs are based on actual insured experience and implicitly incorporate any increased level of costs due to antiselection, more frequent claim diagnosis, and incorrect reporting.

It will be noted that generally there are only small differences in net premiums between columns 2 and 3, although the slope is a bit steeper in column 3. However, there are substantial differences in reserves, with column 3 showing significantly higher amounts at nearly all ages and durations. The importance of selecting a proper scale of antiselection factors is evident.

Column 4 illustrates the tremendous effect on both premiums and reserves of a 1.8 percent annual secular increase in claim costs and dramatizes the need for caution in setting reserve levels if provision is desired for possible claim cost inflation.

The authors are to be commended on their excellent treatment and development of areas heretofore given relatively little study. It is hoped that the remarks and demonstrations provided in this discussion will provoke further consideration and comments.

(AUTHORS' REVIEW OF DISCUSSION)

ANTHONY J. HOUGHTON AND RONALD M. WOLF:

We want to thank Mr. Barnhart, Mr. Habeck and Ms. Doran, and Messrs. O'Grady and Zinzow for submitting discussions to our paper. Their comments are enlightening because they bring out additional points of view regarding reserves for medical expense benefits. In addition, these discussions contain tables that give the profession some additional tools. In making this review, we first will cover some general points made by the discussants and then will review comments that apply to a specific benefit. Many of the observations in the discussions do not require comment, since they involve descriptions of techniques that are valid or express the writer's viewpoint very clearly.

1. *Source of Data*

The first item of a general nature concerns the use of published data, especially data based on the experience of lives covered by individual

medical expense insurance. Most, if not all, recent valuation tables for life insurance and health insurance in the United States have been developed by using data based on the experience of insured lives whenever it was possible to do so, as opposed to using population statistics. This practice has been continued in the development of the 1974 Medical Expense Tables, since they are meant to be valuation standards acceptable to the industry, state insurance departments, and the Internal Revenue Service. Where few or no published data on insured lives are available, use has been made of data based on population statistics and unpublished private statistics, incorporating actuarial models and reasonable assumptions. The claim costs and adjustment factors for cancer expense were developed using the latter approach.

2. *Effects of Secular Trends*

The second general comment concerns the reserve basis for benefits whose recent experience indicates a trend that might justify a projection of the current experience level. Such a projection might apply to the frequency or to the average claim amount. Examples of the first type include the frequency of hospital admissions, surgical procedures, pregnancy, and cancer diagnosis. Examples of the second type include a miscellaneous hospital benefit with a high maximum or a major medical benefit without inside limits.

The use of reserve factors that are based on claim costs that change both by attained age and by time period has substantial implications. First, the reserve factors for each year of issue ought to be unique, or at least unique for several grouped years of issue. Second, if the full cost changes anticipated over the life of the contract cannot be incorporated into the gross premium calculation at issue, it is practically impossible to anticipate the full cost changes in the reserve calculation at issue. A technique of revising reserve factors during the policy term then must be considered. Different viewpoints have been expressed on this subject. At this time, a NAIC committee is considering a recommendation that some recognition of secular trends be made in determining the reserves. We know of no state that currently requires the inclusion of secular trend assumptions in statutory reserves. We also are unaware of any significant amount of reserves being held that have been developed on the basis of realistic assumptions for future changes because of inflation.

Even when secular trend assumptions are to be used to project future net annual claim costs (resulting in a "dynamic" reserving system), a set of basic net annual claim costs is needed for the development of reserve factors. Therefore, the development of static values for benefits

that are likely to change in cost over time is useful. When the particular benefit is a major medical benefit or a miscellaneous hospital benefit with a high maximum, there is little or no disagreement about whether the costs will increase with time. Therefore, the question of recognizing secular trends in statutory reserves for these benefits can proceed without consideration of whether a secular cost increase will occur. A major question in a dynamic reserving approach concerns the proper recognition of the changes in premiums that undoubtedly will parallel the changing morbidity. This question will not be discussed in this review.

The use of a secular trend in the calculation of reserves for benefits such as hospital room and board indemnity benefits, scheduled surgical expense benefits, and fixed amount maternity benefits gives rise to different considerations. Is there any discernible trend? If so, is this trend likely to continue? Is it of significant magnitude to require recognition? In the case of hospital room and board benefits and surgical benefits, we find no evidence that would make an assumption of such a trend more credible than the use of the composite experience of the five years 1968–72. In the case of the $200 maximum miscellaneous hospital benefit, the average claim amounts have been adjusted to a January 1, 1977, level of charges. From that date forward, the possibility of further increases at many attained ages is limited by the maximum amounts. In the case of maternity benefits, we are aware of the significant and continuing trend toward lower birth rates among the general population. Nevertheless, the maternity values in the 1974 Medical Expense Tables are based on composite insured experience of the 1968–72 period.

One could assert that it would have been consistent to project a 1977 level of experience for maternity frequencies and to use the results as static values, as is done for the $200 maximum miscellaneous hospital benefit. This was considered but rejected. Birth rates have been dropping, and the 1977 level may be at an all-time low. It does not seem prudent to construct valuation claim costs on these projected frequencies because an increase in frequencies is as likely a possibility as a further decrease and because such costs might be used for a substantial period of time.

To return to the general question of introducing trends into frequency rates, consider the construction of a new disability table based on the experience of 1970–75. Suppose the data indicate that frequency rates are increasing during this period. Should the tabular values be based on a further projection of the experience under the assumption that the trend will continue, or might the experience be cyclical? If one could determine that the most likely assumption is a long-term upward trend

in cost, should the table be static with average frequency rates, static with the highest expected frequency rates, or dynamic as in a generation annuity table? If the latter approach is selected, how is a provision for change in premiums to be incorporated? Would reserves for noncancelable policies be different from those for guaranteed renewable policies under such a system? As indicated in the summary of the paper, we recognize the questions related to benefits subject to secular trends but have produced static table values only.

3. *Hospital Room and Board Benefit*

The specific points made by Mr. Barnhart and by Mr. Habeck and Ms. Doran about the hospital room and board benefit involve the adjustment factors for maximum benefit periods other than 90 days. Both discussions point out that the recommended adjustment table, which is Table C of the paper "Reserves for Individual Hospital and Surgical Expense Insurance" by Edwin L. Bartleson and James J. Olsen (*TSA*, IX, 339), is out of date and that more recent data suggest different relative costs for the different maximums. The table presented by Mr. Barnhart and labeled the 1974 Hospital Continuance Table is a welcome contribution and improvement, as will be the table that Mr. Habeck and Ms. Doran indicate is in preparation.

4. *Miscellaneous Hospital Benefit*

The projection of average claim amounts for the $200 maximum miscellaneous hospital benefit, which involves annual increase factors that do not vary by attained age, disturbs Mr. Barnhart, and Mr. Habeck and Ms. Doran. They feel that the attained age 17 value is understated by this approach and that possibly the higher age values are overstated. Mr. Barnhart provides a table displaying ratios of the average claim amount in the *1974 Reports* to the average claim amount in the *1972 Reports*. The ratio for attained age 17 appears to be out of line with those for the other ages. Therefore, he suggests that a set of projection factors decreasing by age would produce better results.

Our review of similar ratios developed from the *1972* and *1969 Reports* and from the *1974* and *1972 Reports* suggests that the single projection factor produces satisfactory results for a $200 maximum miscellaneous miscellaneous hospital benefit. The *1972 Reports* to *1969 Reports* ratios vary from 116 percent to 111 percent, with an average of 113 percent. The *1974 Reports* to *1972 Reports* ratios vary from 113 percent to 109 percent at attained ages 30–79, with an average of 111 percent. The conspicuously high ratio for attained age 17 is based on only 219 claims

out of a total of 48,571 claims, and the values for attained age 17 generally are of little importance for net premiums and reserves. The results for the other attained-age groups are based on significantly greater claim volume. A review of the unprojected values in Table 6 of the paper demonstrates that the average claim for this benefit does not increase significantly with age and that the projected values are reasonable. Mr. Barnhart points out that five projected values attained the full $200 maximum, which theoretically cannot occur. All the graduated values used in computing the values in the 1974 Medical Expense Tables are under $200, although some are quite close to that amount. Of the five $200 projected values shown in Table 6, three apply to females aged 47, where the *1972* and *1974 Reports* data each project a $200 benefit value.

The comments relating to the use of a single age projection factor for miscellaneous hospital average claim amounts for higher maximums such as $1,000 are more meaningful. The theoretical arguments for an adjustment that varies by age have merit. Values for a $1,000 maximum benefit have been developed and are presented in Table 1 of this review. These values consist of claim costs, net premiums, and reserve factors for several issue ages and policy durations, and the ratios of such values to the $200 maximum miscellaneous hospital benefit values. The average claim amounts used in the development of the $1,000 maximum miscellaneous hospital benefit values are based on the techniques described in Section V of the paper combined with the age- and sex-specific hospital continuance functions in Mr. Barnhart's Table 2. The ratios of reserve factors do vary by age, sex, and policy duration. These values are more accurate than those produced by a single ratio adjustment.

The all-age miscellaneous hospital benefit adjustment factors in Section V of the paper are appropriate for the adjustment of net annual claim costs. The adjustment factors for midterminal reserves by age and sex are presented in Table 2 for several maximum benefit amounts. These values are superior to those in the paper and are suggested as a replacement. The Table 2 values are developed in a manner similar to that used to obtain the values in Table 1 of this review. The use of the Table 2 values by age and sex adds complexity to the valuation process but clearly is preferable for the practical reason that it avoids the calculation of a complete table of net premiums and reserves for each maximum benefit.

5. *Maternity Benefits*

Mr. Barnhart's comments concern the recognition of a trend that is discernible but that will not necessarily continue in the future. This point

TABLE 1

COMPARISON OF $1,000 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT WITH $200 MAXIMUM MISCELLANEOUS HOSPITAL BENEFIT

(Reserve Factors Based on 1958 CSO Mortality Table, 3 Percent Interest)

Age	$1,000 Maximum Miscellaneous Hospital Benefit					Ratios of $1,000 Maximum Benefit Values to $200 Maximum Benefit Values				
	Net Annual Claim Cost	Term-to-Age 65 Plan, Two-Year Preliminary Term				Net Annual Claim Cost	Term-to-Age 65 Plan, Two-Year Preliminary Term			
		Net Annual Premium	Midterminal Reserve Factors				Net Annual Premium	Midterminal Reserve Factors		
			Policy Year 4	Policy Year 8	Policy Year 13			Policy Year 4	Policy Year 8	Policy Year 13
Male:										
25	$28.08	$ 50.10	$34.99	$127.25	$232.37	2.4	2.6	3.1	3.1	3.2
35	36.41	62.48	36.37	122.19	201.68	2.5	2.7	3.3	3.3	3.4
45	54.42	77.44	30.40	95.54	131.50	2.6	2.8	3.4	3.5	3.5
55	78.37	96.73	20.63	33.11	.....	2.8	2.9	3.6	3.6	.....
Female:										
25	47.68	69.51	31.35	108.28	185.51	2.3	2.7	3.8	3.8	3.8
35	60.72	79.47	25.43	83.39	133.94	2.5	2.8	3.9	3.9	4.0
45	75.30	89.43	19.14	57.99	75.27	2.7	2.9	4.3	4.4	4.6
55	91.74	100.55	10.32	16.10	.....	2.9	3.0	5.1	5.1	.....

TABLE 2

MISCELLANEOUS HOSPITAL EXPENSE BENEFIT FACTORS TO ADJUST $200 MAXIMUM BENEFIT RESERVES TO CORRESPONDING RESERVES FOR OTHER MAXIMUMS

(January 1, 1977, Level of Charges)

ISSUE AGE	$300	$400	$500	$750	$1,000	$2,000	$5,000
Male:							
Under 30	1.4	1.8	2.2	2.8	3.1	3.7	4.1
30–39	1.5	1.9	2.2	2.9	3.3	4.1	4.5
40–49	1.5	1.9	2.3	3.0	3.5	4.4	5.0
50–59	1.5	1.9	2.3	3.0	3.6	4.7	5.5
60 and over	1.5	1.9	2.3	3.1	3.7	5.0	6.0
Composite, male	1.5	1.9	2.3	2.9	3.3	4.1	4.6
Female:							
Under 30	1.5	2.0	2.4	3.3	3.8	4.6	5.0
30–39	1.5	2.0	2.4	3.3	3.9	4.9	5.3
40–49	1.5	2.0	2.5	3.6	4.4	5.9	6.7
50–59	1.6	2.1	2.7	4.0	5.1	7.2	8.5
60 and over	1.6	2.1	2.9	4.4	5.7	8.5	10.5
Composite, female	1.5	2.0	2.5	3.4	4.0	5.1	5.6
Composite, male and female	1.5	1.9	2.4	3.1	3.6	4.5	5.0

was commented on previously. To put the magnitude of the comment in perspective, Table 3 shows a comparison of values from the 1974 Medical Expense Tables with similar values developed exclusively from the *1974 Reports* data. The differences do not appear to be significant. We continue to believe that the composite experience of the five-year period 1968–72 is an acceptable base for maternity reserves.

6. *Consistency with Latest Experience—Hospital and Surgical Expense Benefits*

Mr. O'Grady's discussion contains tests of consistency between hospital and surgical net annual claim costs of the 1974 Medical Expense Tables and similar values from the *1977 Reports*, which are based on 1973–74 experience. His analysis covers hospital frequencies, average hospital stays, miscellaneous hospital average claim amounts, surgical claim costs, and maternity frequencies.

Calculations by Mr. O'Grady show that the inclusion of the 1973–74 experience with the 1968–72 experience, when combined with the construction methods applied to the 1968–72 data base, produces new values

TABLE 3

$100 MATERNITY BENEFIT

(Reserve Factors Based on 1958 CSO Mortality Table, 3 Percent Interest)

Issue Age	Net Annual Claim Cost	Term-to-Age 65 Plan, Two-Year Preliminary Term			
		Net Annual Premium	Midterminal Reserve Factors		
			Policy Year 4	Policy Year 8	Policy Year 13
	Values Based on *1974 Reports* Data				
20	$29.24	$7.97	−$26.58	−$84.61	−$123.80
30	11.48	1.88	− 8.71	− 22.53	− 26.87
40	1.61	0.16	− 1.01	− 2.01	− 1.58
	Ratio of Values from 1974 Medical Expense Tables to Values Based on *1974 Reports* Data				
20	0.96	0.93	0.96	0.96	0.95
30	0.93	0.89	0.91	0.89	0.88
40	0.85	1.07	0.89	1.06	1.09

that do not vary appreciably from those developed for the 1974 Medical Expense Tables. Although the *1977 Reports* data indicate the existence of trends for some benefits, it appears that the values of the 1974 Medical Expense Tables would not have changed significantly if the authors had had these data available when constructing the tables in 1976.

7. *Consistency with Latest Experience—Major Medical Expense Benefits*

The points raised in the discussions may be grouped under several assertions.

i) *No specific table should be recommended as a guide for statutory valuation. Each company should develop its own reserve values on the basis of its marketing activities, geographical area of operation, pricing assumptions, and rate revision philosophy.*

Mr. Barnhart, and Mr. Habeck and Ms. Doran question the advisability of having a single major medical valuation table. Mr. Barnhart believes that the provider costs for any large block of experience might be very different from those for an individual company's block of business, so that the reserves based on the available experience could overstate the company's liabilities. This position has merit on a theoretical

basis. However, the argument applies also to other health insurance benefits. We have known companies whose basic hospital room and board costs deviate materially from the intercompany average. Table 9 of the *1974 Reports* shows that for the $200 maximum miscellaneous hospital benefit the average claim amounts of the two largest contributors differ by about 12 percent, a significant difference.

In the disability income field, some companies sell primarily to professionals, while others sell primarily to farmers and blue-collar workers. The assertion that each company's block of business might be so special that it must base reserves without regard to a standard table or must modify a standard table can be made for many health coverages. If one accepts this assertion, its applicability extends well beyond major medical insurance.

ii) *The trend factor used to combine the* 1972 *and* 1974 Reports *data and to project these combined data to 1978 is arbitrary and appears low in relation to current industry trends.*

Mr. Zinzow suggests that 12.2 percent is low and considers 14–18 percent to be common in current rating practices. Mr. Barnhart says that "most insurers actually have experienced annual trend rates on major medical benefits of 15 percent up to even about 25 percent." Perhaps there is a problem with the time frame within which we have been working. The experience used covers 1968–70 for the *1972 Reports* and 1971–72 for the *1974 Reports*. The seventy-two-month period from January, 1972, to January, 1978, includes twenty-seven months (November, 1971—April, 1974) during which the federal government imposed limitations on health providers. These limitations resulted in some slowdown in the rate of increase in provider costs during this period. However, a more important fact is that the actual experience in the *1974* and *1977 Reports* shows some reduction in the rate of increase of major medical costs for the unlimited benefit plans shown in Table 21 of these *Reports*. This last point is discussed further.

iii) *The* 1972 Reports *values, projected forward for two and one-half years at 12.2 percent, consistently exceed the* 1974 Reports *values.*

Mr. Barnhart's comment is correct, but what is the most appropriate method of recognizing this fact? The *1972 Reports* data could be disregarded and only the *1974 Reports* data used, even though the latter contain only 27 percent of the claim volume of the former. Alternatively, the data in the *1974 Reports* could be disregarded. Another method would be to add the claims and exposures in the two *Reports*, with the resulting claim costs labeled as being representative of the weighted

average midpoint, namely, March, 1970. This technique would result in lower claim costs and a longer period over which to project forward to the current level of claim costs. None of these approaches is felt to be superior to the technique used, which is commonly employed when using the experience from different time periods.

Mr. Barnhart suggests that the "combined" values appear overstated because of the 12.2 percent annual trend factor. A higher trend factor would result in a greater discrepancy between the two *Reports*, while a lower trend factor seems to be contrary to the feelings expressed in the discussions and in private conversations that the 12.2 percent factor is low.

Shown in column 4 of Table 4 are ratios of actual to expected claim amounts for males and females under age 65. The expected claims are based on the claim costs from the 1974 Medical Expense Tables adjusted for a 75 percent coinsurance factor and the average maximum benefit.

If the expected values fit the actual experience well and if the 12.2 percent trend factor is suitable for this period, the ratios in column 4 should be approximately equal to the factors that appear in column 5. Table 4 shows that 1973–74 costs from the *1977 Reports* are higher than the tabular values but not as high as one would have expected on the basis of a trend rate of 12.2 percent or higher. If our values for the 1972 level of charges are overstated, time has caught up with them, resulting in a historical problem but not a current problem. In other words, if the values for the 1972 level of charges are more appropriate for 1973, an annual trend rate of 15 percent is necessary for the years 1973–78 to reach the projected 1978 level of charges.

Column 6 of Table 4 contains the expected claims adjusted to the midpoint of each experience period by using the 12.2 percent annual trend rate. If the ratios of actual to adjusted expected claims in column 7 were exactly 1.00, it would mean that the tabular claim costs and the 12.2 percent trend rate produce a close fit to the year-by-year actual experience. The values in column 7 are close enough to 1.00 to lend credibility to the values from the 1974 Medical Expense Tables.

Table 5 demonstrates the difficulties of projecting costs and then achieving a fit with published data. This table is the same type of table Mr. Barnhart includes in his discussion in order to compare the *1972 Reports* data with values developed from a paper by Mr. Barnhart using a unit value of $8. He makes his comparison with the *1972 Reports* data because of the much larger claim volume than in the *1974 Reports*. Table 5 contains a comparison of Mr. Barnhart's claim costs with a unit value of $11 and the corresponding claim costs in the *1974 Reports*.

TABLE 4

COMPARISON OF ACTUAL CLAIMS FROM *TSA Reports*, TABLE 21, TO EXPECTED CLAIMS* FOR AGES 20–64

Source	Midpoint of Experience (1)	Actual Claim Amounts (2)	Expected Claim Amounts Based on 1972 Level of Charges* (3)	Ratio [(2)/(3)] (4)	Factor to Adjust Expected Claims to Midpoint of Experience, Based on 12.2% Annual Increase (5)	Expected Claim Amounts Based on 1972 Level of Charges Adjusted to Midpoint of Experience [(3)×(5)] (6)	Ratio [(2)/(6)] (7)
TSA, 1969 Reports	Jan., 1967	$ 6,499,703	$12,701,340	0.51	0.56	$ 7,112,750	0.91
TSA, 1972 Reports	July, 1969	13,259,544	16,900,840	0.78	0.75	12,675,630	1.05
TSA, 1974 Reports	Jan., 1972	5,643,917	6,308,016	0.89	1.00	6,308,016	0.89
TSA, 1977 Reports	Jan., 1974	3,079,663	2,838,488	1.08	1.26	3,576,495	0.86
Total		$28,482,827				$29,672,891	0.96

* Expected claims are equal to claim costs from the 1974 Medical Expense Tables (1972 level of charges) divided by 1.116 to reflect 75 percent coinsurance and the average maximum benefit and multiplied by exposures for each cell from the applicable Table 21.

TABLE 5

ANNUAL CLAIM COSTS, MAJOR MEDICAL BENEFIT
$500 DEDUCTIBLE, $10,000 MAXIMUM BENEFIT

AGE	MALE			FEMALE		
	A	B	B/A	A	B	B/A
22.....	$ 37.20	$ 38.46	1.034	$ 22.79	$ 56.67	2.487
27.....	19.17	41.65	2.173	34.21	70.00	2.046
32.....	26.44	48.18	1.822	46.56	85.59	1.838
37.....	50.88	59.36	1.167	58.99	104.64	1.774
42.....	50.12	75.45	1.505	81.50	122.60	1.504
47.....	60.72	97.35	1.603	86.10	136.55	1.586
52.....	91.51	125.94	1.376	107.37	151.51	1.411
57.....	165.62	159.88	0.965	126.32	170.55	1.350
62.....	190.57	204.01	1.071	146.28	199.85	1.366
Average.....			1.413			1.707

NOTE.—A = *1974 Reports*, Table 21; B = *TSA*, XXI, 31-32, Table 1, k = $11.

What does this table show? The purpose of Mr. Barnhart's table is to show how well the valued unit approach holds up in relation to the experience in the recent *Reports*. The comparison of his values with those from the *1972 Reports* produces ratios with an arithmetic average of 0.99 for males and 1.33 for females. The comparison with the *1974 Reports* values produces ratios with an arithmetic average of 1.41 for males and 1.71 for females. Our interpretation of the two comparisons is that the *1972 Reports* values are reasonably close to those that Mr. Barnhart's tables would have anticipated for males, but that the *1974 Reports* values fall far short of the anticipated values. In the case of females, both the *1972* and *1974 Reports* data produce costs that are substantially lower than anticipated in Mr. Barnhart's tables.

To summarize, while the combination of the *1972* and *1974 Reports* data produces values that are not consistent with the *1974 Reports* data, it is not possible to derive a set of values that is consistent in this respect and at the same time consistent with the *1972 Reports* data or the underlying experience of Mr. Barnhart's tables. This is because the data from each period are erratic and inconsistent with one another. Mr. Barnhart has mentioned the existence of an anomaly in the age and sex slope. When all sources of available major medical experience are examined and compared, we find many changing relationships and levels of charges that are different from those one might expect by projecting earlier data.

Such comparisons point out the difficulty of the problem and the sources of critical comment but do not suggest a better approach that corrects the inherent problems.

iv) *The adjustment table for reserves for other combinations of maximums, deductibles, and inside limits contains single ratios that are not theoretically accurate for every combination of age, sex, and policy duration.*

We agree with Mr. Barnhart's comment. However, the reasons for adopting a practical rather than a theoretical approach are based on the following facts:

a) The major medical expense benefit values in the 1974 Medical Expense Tables, which are based on a $500 deductible, $10,000 maximum, and 80 percent coinsurance, comprise 112 pages.

b) Adjustment factors for fifty-four different combinations of deductibles and maximums are suggested in the introduction to the major medical expense benefit values.

c) The printing of all values for every combination of deductible and maximum is impractical.

d) Many companies have numerous combinations of deductibles and maximums, but often one or two combinations represent 80 percent of their business. The use of a basic set of factors is convenient for them. Some loss in accuracy is justified to keep the time, effort, and cost of the valuation within reasonable bounds.

Because the 1974 Medical Expense Tables are intended primarily to serve as reserve tables, the adjustment factors shown are meant to be applied to the reserve factors rather than to the net annual claim costs or the net annual premiums. Table 6, with claim costs based on *TSA*, XXI, 31–32, Table 1, and a unit value of $11, compares the $500 deductible, $10,000 maximum plan with the $1,500 deductible, $10,000 maximum plan with respect to claim costs, net premiums, and reserve factors for several ages and policy durations. The ratios of reserves for the $1,500 deductible plan to those for the $500 deductible plan vary from 0.61 to 0.68 for males and from 0.52 to 0.66 for females. If we use an age distribution of 20 percent at age 25, 60 percent at age 40, and 20 percent at age 55, a policy-year distribution of 50 percent at policy year 4, 20 percent at policy year 8, and 20 percent at policy year 13, and a sex distribution of 50 percent male and 50 percent female, the composite ratio of the reserves is 0.60 on Mr. Barnhart's table, as opposed to 0.79 suggested in the paper.

Table 7 contains a summary of major medical reserve adjustment ratios

TABLE 6

MAJOR MEDICAL EXPENSE BENEFIT

(Claim Costs from *TSA*, XXI, 31–32, Table 1;
Reserve Factors Based on 1958 CSO Mortality Table, 3 Percent Interest)

Age	Net Annual Claim Cost	Net Annual Premium	Two-Year Preliminary Term Midterminal Reserve Factors		
			Policy Year 4	Policy Year 8	Policy Year 13
	$500 Deductible, $10,000 Maximum, $11 Unit Value				
Male:					
25	$ 40.06	$ 83.83	$66.51	$246.23	$462.31
40	68.46	124.00	76.24	252.87	390.97
55	145.81	183.54	39.62	66.51	.....
Female:					
25	64.48	116.63	73.21	251.81	425.92
40	116.65	149.77	44.40	143.28	223.19
55	162.66	184.61	26.31	47.82	.....
	$1,500 Deductible, $10,000 Maximum, $11 Unit Value				
Male:					
25	$ 13.89	$ 40.86	$40.49	$149.41	$280.16
40	31.30	65.23	46.35	154.50	243.91
55	77.77	103.01	26.50	45.20	.....
Female:					
25	16.15	42.87	37.94	132.28	228.90
40	40.88	61.16	27.00	87.90	138.54
55	68.03	83.12	17.27	31.39	.....
	Ratio of $1,500 Deductible Plan to $500 Deductible Plan				
Male:					
25	0.35	0.49	0.61	0.61	0.61
40	0.46	0.53	0.61	0.61	0.62
55	0.53	0.56	0.67	0.68	.....
Female:					
25	0.25	0.37	0.52	0.53	0.54
40	0.35	0.41	0.61	0.61	0.62
55	0.42	0.45	0.66	0.66	.....

TABLE 7

COMPARISON OF MAJOR MEDICAL RESERVE ADJUSTMENT RATIOS

Plan			Derived from TSA, XXI, 31–32, Table 1	From Table 18, Section A
k-Value	Deductible	Maximum		
$11	$ 500	$10,000	1.00	1.00
11	1,500	10,000	0.60	0.79
11	1,500	25,000	0.65	1.01
20	500	10,000	1.83	2.00
20	1,500	10,000	1.40	1.58
20	1,500	25,000	1.49	2.02

derived from *TSA*, XXI, 31–32, Table 1, and ratios taken from Section A of Table 18 of the paper, for the benefit plans in Table 3 of Mr. Barnhart's discussion.

The major medical continuance factors in the 1974 Medical Expense Tables produce a smaller reduction for a larger deductible than that produced by Mr. Barnhart and, conversely, a greater upward adjustment as the maximum increases.

It is almost unavoidable that an interpretation of prior available data and a reasonable projection of those data will appear erroneous when the current experience is inconsistent with the prior experience or when the actual trend is substantially different from that assumed.

8. *Cancer Expense Benefit*

The discussions on the cancer claim costs and resulting net premiums and reserves indicate that there is some misunderstanding about our explanation of the development of claim costs for cancer benefits using all-cause claim costs as a starting base.

Mr. Habeck and Ms. Doran state that our method assumes that the average duration of hospital stays for cancer is the same for all ages. This is not correct. Our method assumes that the slope of average claims by age for cancer is the same as the slope of average claims for all causes. The average claim amount for all causes can be approximated by dividing the all-cause net annual claim costs in column 1 of Table 20 by the hospital frequency rates in Table 4 of the *1974 Reports*. These average amounts range from $538 at age 22 to $924 at age 72 for males, and from $454 at age 22 to $865 at age 72 for females. Our adjustment for cancer claim costs retains this slope, although it assumes larger average amounts for each age. Our technique results in a steeper slope for cancer frequencies than for all-cause frequencies.

Mr. Barnhart questions "the application of the 8.2 percent factor at all ages." The assumed ratio of cancer hospital days to all-cause hospital days for males aged 22 is 0.017, or less than 2 percent, while the ratio of cancer hospital days to all-cause hospital days for males aged 72 is 0.158. The aggregate ratio for all ages is 0.082, but such a ratio has not been applied uniformly to each age.

There also is a misconception about the relationship between a single-admission hospital stay and a diagnosis of cancer. The numbers of cancer diagnoses and the frequencies of diagnosis per 100,000 lives exposed for each age and sex cell were obtained from the National Cancer Institute Monograph No. 41. Often there is treatment during the year following the year of diagnosis. Some sources of information indicate that

the average number of hospital confinements per diagnosis is about 1.8. One such reference is the table in the *Proceedings of the Conference of Actuaries in Public Practice,* XXVI, 448, that was included in a presentation by Mr. W. Keith Sloan.

The loading applied to the basic claim costs has caused some concern. Generally, a flat dollar loading has no appreciable effect on midterminal reserves but does increase the net premiums and the resulting unearned premium reserves. A level percentage loading increases both net premiums and reserves by the specific percentage. Our loading is an increasing dollar amount for a substantial part of the age range because the decreasing percentages are applied against larger annual claim costs. The loading reduces at the highest ages and disappears entirely at age 77.

Table 8 compares reserve factors with and without the loading for several issue ages and policy durations. The mixture of higher reserves and lower reserves results in approximately the same aggregate reserve amount for a realistic age and sex distribution.

Mr. Zinzow, who has access to morbidity from industry sources, describes a very sophisticated method of calculating claim costs. As we understand his discussion, the values he would obtain from his independent calculations are shown in column 3 of Table 1 in his discussion. If he were to introduce a secular trend factor into his calculation, the

TABLE 8

COMPARISON OF NET ANNUAL PREMIUMS AND MIDTERMINAL RESERVE FACTORS FOR CANCER EXPENSE BENEFITS BASED ON CANCER NET ANNUAL CLAIM COSTS WITH AND WITHOUT LOADING FOR ANTISELECTION

(Reserve Factors Based on 1958 CSO Mortality Table, 3 Percent Interest)

Issue Age	Net Annual Premium		Two-Year Preliminary Term Midterminal Reserve Factors					
			Policy Year 4		Policy Year 8		Policy Year 13	
	With Loading	Without Loading	With Loading	Without Loading	With Loading	Without Loading	With Loading	Without Loading
Male:								
35...	$15.98	$12.38	$21.74	$18.11	$81.16	$68.36	$153.36	$132.38
45...	23.62	18.85	25.13	22.90	88.40	82.50	152.09	148.14
55...	33.89	28.51	21.50	23.24	67.99	77.15	102.09	124.55
Female:								
35...	16.91	12.09	16.03	13.52	53.35	46.84	84.15	79.68
45...	21.78	16.42	8.78	10.41	27.53	34.91	41.68	58.05
55...	24.99	20.50	4.44	7.99	13.96	26.62	22.81	44.87

results would be as shown in column 4 of his Table 1. The reserve factors produced using his claim costs, particularly those developed using a secular trend assumption, differ from ours for some of the most important insuring ages.

Our calculation did treat the hospital benefits and physician benefits as indemnities because we believe there will be no salvage between the allowances and the actual charges. For radiation therapy, not all claims will be for the maximum benefit amount.

We understand that while Mr. Zinzow's table refers to 1.8 percent per year claim cost inflation, he actually is referring to an increase in the cancer frequency rate. This frequency rate may be increasing, although our private utilization statistics, which showed increasingly larger ratios of cancer to all causes for the years 1973–75, did stabilize and drop slightly to 8.0 percent for the twelve months ending April, 1978.

Because Mr. Zinzow's claim costs are based on actual experience, we would appreciate seeing his information, specifically the cancer frequency rates, the average claim amounts, and the claim costs.

For cancer insurance, where no published experience is available, disagreements will arise about the absolute and relative claim costs, especially when different experience emerges from companies selling insurance through different marketing techniques and in different geographical areas. Age- and sex-specific claim costs derived directly from a credible volume of insured cancer experience will help actuaries to converge on proper values.

As a final comment on cancer, we would reply to Mr. Habeck and Ms. Doran that we never advocate using valuation claim costs for gross premium calculations. Occasionally, the same source of data from which valuation claim costs were derived is suitable as a starting point in the determination of gross premiums. To complete the derivation of the gross premiums, consideration also is given to select factors, underwriting standards, claim administration practices, geographical areas of operation, and appropriate contingency margins. The relationships among gross premium assumptions for various benefit combinations may be similar to the relationships used in adjusting reserves for different benefit combinations.

9. *Medicare Supplementary Expense Benefit*

We agree with Mr. Habeck and Ms. Doran that it is impossible to calculate properly the value of deferred benefits unless a continuance table treats reentries within a spell of illness (60 days) as extensions of the original admission.

We used Mr. Barnhart's 1974 Hospital Continuance Table to calculate net annual claim costs for males and females aged 67 and 72 for the $25 daily hospital benefit, days 61–90, and for the $50 daily hospital benefit, days 91–150. Table 9 compares, for our Table 26 and Mr. Barnhart's table, the hospital frequencies, average hospital stays, and the resulting claim costs.

The hospital frequencies in our table are higher, which may be explained partially by the 10 percent margin we included because medicare supplementary policies often are sold on a guaranteed issue basis. Mr. Barnhart's values for average stays for males between the 61st and 150th days are approximately equal to ours, while his values for average stays for females are substantially less than ours. This occurs even though Mr. Barnhart's average stays for the first 90 days are

TABLE 9

MEDICARE SUPPLEMENTARY BENEFIT—HOSPITAL COMPONENT VALUES

Attained Age	Hospital Frequency		Net Annual Claim Cost $100 Initial Hospital Deductible	
	1974 Medical Expense Tables	Mr. Barnhart's Table	1974 Medical Expense Tables	Mr. Barnhart's Table
Male:				
67	0.2415	0.2095	$24.15	$20.95
72	0.2905	0.2519	29.05	25.19
Female:				
67	0.2118	0.1756	21.18	17.56
72	0.2320	0.2095	23.20	20.95

Attained Age	Average Stay for Days 61–90		Average Stay for Days 91–150		Net Annual Claim Cost, $25 Daily Hospital Benefit, Days 61–90		Net Annual Claim Cost, $50 Daily Hospital Benefit, Days 91–150	
	1974 Medical Expense Tables	Mr. Barnhart's Table	1974 Medical Expense Tables	Mr. Barnhart's Table	1974 Medical Expense Tables	Mr. Barnhart's Table	1974 Medical Expense Tables	Mr. Barnhart's Table
Male:								
67	0.5448	0.5603	0.4030	0.4611	$3.29	$2.93	$4.87	$4.83
72	0.6540	0.6484	0.4840	0.5125	4.75	4.08	7.03	6.45
Female:								
67	0.5175	0.3599	0.3824	0.2717	2.74	1.58	4.05	2.39
72	0.6466	0.4711	0.4767	0.3518	3.75	2.47	5.53	3.69

similar for males and females. Apparently, his underlying basic data showed a pattern of hospital terminations that differed significantly between males and females for the longer stays, while the data we used did not indicate this pattern.

We are surprised that Mr. Habeck and Ms. Doran estimate costs at less than one-third of our values.

10. *Summary*

We wish to thank the discussants for their time, effort, and contributions. In his discussion, Mr. Barnhart says that "the 1956 Intercompany Hospital and Surgical Tables are, without question, the most obsolete reserve tables that still enjoy official recognition as 'statutory minimum standards.' " Mr. O'Grady, chairman of the Committee on Health Insurance, indicates his satisfaction that the Society's efforts in compiling and reporting individual medical expense experience have received a valuable application in the development of the 1974 Medical Expense Tables. The obsolescence of the current tables and the availability and appropriateness for the construction of new tables of the intercompany data in the *TSA Reports* are the basic premises underlying our development.

In computing the values that comprise the 1974 Medical Expense Tables and the related adjustments to these tabular values, many decisions as to technique and use of data were made after considering a number of alternatives. We are pleased that the discussants recommend relatively few modifications of the claim costs for basic hospital and surgical benefits. The construction of the major medical values is an exception, as two of the discussions take the position that a specific table is counterproductive and that each company should determine statutory reserves based on the unique characteristics of its benefits, markets, and pricing methods.

The discussions contain some constructive suggestions and information that we wish to accept and use as improvements to our original adjustment tables. One of these is the 1974 Hospital Continuance Table presented by Mr. Barnhart. Also, the discussions have prompted our development of revised adjustment tables for miscellaneous hospital benefits.