

## A NEW TABLE FOR ACCIDENTAL DEATH BENEFITS

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A STUDY of the combined experience of 17 large companies on accidental death benefits between 1951 and 1956 policy anniversaries was presented by the Committee on Disability and Double Indemnity in *TSA* 1958 Reports. The death rates were found to differ markedly from those in the 1926-33 Intercompany Double Indemnity Table. There was a substantial improvement at all ages, but since the percentage of reduction tended to increase with advancing age within the age range generally covered by the double indemnity benefits offered by life insurance companies, the curve of death rates in the new experience was much flatter than the 1926-33 Table.<sup>1</sup> This can be expected to result in a lower level of reserves than are required by the 1926-33 Table, which is at present generally recognized in the insurance laws for valuation purposes.

It appears appropriate to use the more modern experience as a basis for a revised valuation standard. Even aside from the desirability of updating the laws in this respect, we can expect that the companies will turn to the new data as a basis for their operations, and this in itself will generate a need for replacing the 1926-33 Table with a new table.

It is the purpose of this paper to present a table of accidental death rates, based on the new intercompany experience data, that we believe to be suitable for use as a valuation standard. Table 3 on page 50 of the report contains a graduated set of accidental death rates for the aggregate experience entering the new study. We considered the appropriateness of using these published rates for valuation purposes, but concluded that it was essential that they be increased somewhat. This is in keeping with the comments which appear on page 52 of the report, where it is stated that the graduated rates "were produced for analysis purposes only, and not as a table deemed suitable for premium or valuation purposes." Several reasons are there cited why the graduated rates might not be appropriate for the latter purposes.

The factors considered in arriving at our conclusion and in designing the suggested table are outlined and discussed below:

1. There were wide fluctuations in the experience among the 17 individual contributing companies, with a good number of them having an

<sup>1</sup> See Tables 2 and 3 of the Committee's 1958 report, which will hereafter be referred to as "the report."

over-all result which was well over 100% of the average experience. Table 14 of the report shows that the over-all mortality ratios by amounts of insurance for the aggregate experience of each company relative to the graduated rates for all companies ranged from 50% to 169%. Of the 17 companies, seven had ratios in excess of 110%. Thus the use of the graduated rates without adjustment would even fall short of covering the experience of a substantial number of companies that contributed to the study.

Table 1 presented herewith shows the mortality ratios in five year attained age groups for each of the contributing companies, the companies being arranged in the same sequence as in Table 14 of the report. The range of the variation in the ratios as thus subdivided is noteworthy, and of some significance in establishing a table to be used for valuation purposes. The distribution of the mortality ratios appearing in Table 1 is summarized in Table 2.

2. It can be expected that many companies that did not contribute to this study will have an experience which departs significantly from the average of these 17 large companies. The distribution of the ratios shown in Table 2 for cells involving 10 to 24 claims, as compared with the distribution for cells with 25 or more claims, may be an indication of the fluctuations that are likely in small or medium size company data. In the 10 to 24 claim category, 35% of the cells had ratios of 130% or more.

3. In addition to the variation in the distribution of mortality ratios by size of company, variation can also be expected because of the differences in the distribution of business among the companies by sex, geographic area, occupation and other factors correlated significantly with accidental death rates.

By way of illustrating the variations that are possible in the matter of the proportion of business written on women, it may be noted that among the ten companies which contributed material in the intercompany study to the analysis of the results by sex, the proportion of the exposed to risk which was on female lives ranged from 27% to 8% by numbers of policies and from 14% to 4% by amounts of insurance. Because of the relatively favorable claim rates on women, the lower the female proportion the higher can we expect the over-all claim rates to be.

Geographic area is of pertinence because of the higher accidental death rates which prevail in rural districts, as repeatedly evidenced by population statistics. It was noted in the report, for example, that "the two companies with the highest policy ratios [of actual to expected] do much of their business in farm states" (page 68).

4. As stated in the report, the period between 1951 and 1956 policy

**TABLE 1**  
**ANALYSIS BY COMPANY—ALL YEARS OF ISSUE AND POLICY DURATIONS COMBINED**  
**MORTALITY RATIOS (BY AMOUNT OF INSURANCE) RELATIVE TO GRADUATED 1951-1956 RATES**

COM- PANY CODE	ATTAINED AGE																All	
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84		85-89
	MORTALITY RATIOS																	
A	* %	* %	* %	* %	* %	* %	* %	* %	79%	* %	* %	* %	—	—	—	—	—	50%
B	*	*	117	111	96	106	75	56	66	85	68	54	—	—	—	—	—	84
C	*	*	*	75	54	140	79	66	61	90	*	*	—	—	—	—	—	85
D	60	26	103	98	88	90	81	87	106	90	84	72	79	132	94%	202%	*	91
E	66	66	84	90	79	98	93	96	103	115	94	126	119	99	*	*	*	94
F	*	*	165	117	67	78	94	93	124	123	91	*	*	—	—	—	—	99
G	—	*	131	103	133	115	95	102	83	95	126	100	69	65	88	116	*	101
H	—	*	*	88	79	98	133	128	116	99	48	*	*	70	—	—	—	102
I	*	*	135	74	117	117	122	113	112	102	134	129	114	—	74	45	*	107
J	—	*	*	*	*	179	90	144	50	93	*	*	—	—	—	—	—	108
K	*	73	118	129	91	129	125	125	104	103	104	95	121	119	115	103	*	113
L	—	—	*	94	170	100	60	184	*	*	*	*	—	—	—	—	—	117
M	*	*	231	153	70	120	38	139	170	*	*	*	—	—	—	—	—	118
N	—	—	*	110	70	138	161	119	139	96	134	—	—	—	—	—	—	121
O	—	*	95	114	151	82	204	110	173	107	*	*	—	—	—	—	—	128
P	*	*	*	140	126	204	96	115	139	71	217	*	*	*	—	—	—	130
Q	*	*	*	189	175	159	256	141	135	*	—	—	—	—	—	—	—	169
	NUMBER OF CLAIMS (POLICIES)																	
A	0	0	2	2	2	6	6	4	13	9	5	1	—	—	—	—	—	50
B	0	1	28	59	56	65	68	56	52	37	21	10	—	—	—	—	—	453
C	—	0	8	16	16	34	28	30	20	16	8	0	0	0	—	—	—	176
D	15	20	183	431	429	468	513	509	489	378	272	194	165	111	57	26	5	4,265
E	—	42	327	636	432	486	440	426	355	261	160	106	24	18	6	8	0	3,727
F	0	3	11	12	13	21	30	38	43	28	16	9	0	—	—	—	—	224
G	—	5	73	139	125	131	139	145	148	163	147	129	57	45	35	18	2	1,501
H	—	—	0	16	14	23	30	33	50	15	14	5	1	—	—	—	—	201
I	1	1	37	40	40	65	109	120	127	144	175	136	100	72	50	26	6	1,249
J	—	0	1	6	7	11	10	15	13	11	5	1	—	—	—	—	—	80
K	3	19	137	258	178	228	278	338	375	348	337	279	228	182	137	55	8	3,388
L	—	—	3	5	10	29	13	11	13	6	3	0	—	—	—	—	—	93
M	0	0	12	24	12	16	13	20	19	7	9	0	—	—	—	—	—	132
N	—	—	9	27	22	32	45	26	19	13	12	—	—	—	—	—	—	205
O	6	5	33	61	54	37	48	21	23	12	7	2	—	—	—	—	—	309
P	—	0	4	22	20	22	29	44	31	14	16	6	0	0	—	—	—	208
Q	0	0	2	11	10	11	17	12	13	9	2	—	—	—	—	—	—	87

\* Ratios not shown where number of claims was less than 10. Dashes appear where there was no exposure.

TABLE 2  
 DISTRIBUTION OF MORTALITY RATIOS OF INDIVIDUAL  
 COMPANIES IN FIVE YEAR AGE GROUPS  
 (Ratios Expressed Relative to Graduated  
 1951-56 Experience)

MORTALITY RATIO	NUMBER OF COMPANY-AGE GROUP CELLS WITH SPECIFIED RATIO		
	25 or More Claims in Cell	10 to 24 Claims in Cell	10 or More Claims in Cell
200% or more . . . . .	2	4	6
195-199 . . . . .			
190-194 . . . . .			
185-189 . . . . .		1	1
180-184 . . . . .		1	1
175-179 . . . . .		1	1
170-174 . . . . .	1	2	3
165-169 . . . . .		2	2
160-164 . . . . .	1		1
155-159 . . . . .		1	1
150-154 . . . . .	1	1	2
145-149 . . . . .			
140-144 . . . . .	1	3	4
135-139 . . . . .	2	2	4
130-134 . . . . .	6	2	8
125-129 . . . . .	8	1	9
120-124 . . . . .	4	1	5
115-119 . . . . .	10	3	13
110-114 . . . . .	7	1	8
105-109 . . . . .	2	1	3
100-104 . . . . .	9	1	10
95-99 . . . . .	7	4	11
90-94 . . . . .	10	5	15
85-89 . . . . .	4	1	5
80-84 . . . . .	6		6
75-79 . . . . .	3	3	6
70-74 . . . . .	5	4	9
Less than 70 . . . . .	7	12	19
130 or more . . . . .	14	20	34
100 to 129 . . . . .	40	8	48
70 to 99 . . . . .	35	17	52
Less than 70 . . . . .	7	12	19
All . . . . .	96	57	153

anniversaries covered by the investigation was probably "a favorable one from a claim point of view because of the good economic conditions which prevailed. For example, companies are not always successful in excluding suicides when paying accidental death benefit claims, and in depressed times such claims are bound to be more frequent than in prosperous times." The Equitable's experience over the years is illustrative of this point. Its over-all crude claim rate (not adjusted for age) averaged .46 per 1,000 in the years 1925 to 1929, rose to an average of .53 in 1930 to 1934, and dropped back to .45 in 1935 to 1939.

5. Changes adopted by companies in recent years in their definition of the benefit and in the underwriting of the coverage can be expected in themselves to result in higher claim rates than might otherwise emerge. Passenger aviation deaths are now more widely insured, and a trend toward the use of "accidental result" rather than "accidental means" in writing or administering the benefit will also admit more claims. There has in addition been a trend toward writing larger amounts of double indemnity benefits. This may have a significant effect in raising the level of claim rates as there is substantial evidence in the report and in collateral data that higher claim rates are associated with larger policies. Information in support of this statement will be found in Tables 7, 11 and 12 of the report.

#### MARGINS ADOPTED RELATIVE TO 1951-1956 EXPERIENCE RATES

In view of the above considerations, it seemed clear to us that some margin should be added to the experience rates in the development of a new standard for the accidental death benefit. As to the extent of the margin, we considered the ratios set forth in Table 1 and the distribution in Table 2 to be of particular pertinence. In keeping with the thinking that went into the construction of the 1958 CSO Table, it was our view that the rates appearing in a standard table should cover a high proportion of the individual company variations from the average. Using the graduated aggregate experience rates in Table 3 of the report as a base, we have accordingly constructed a new table, proposed as the 1959 Accidental Death Benefits Table, by adding a margin equal to 30% of the experience rate, subject to a minimum addition of .10 per 1,000 and a maximum addition of 1.00 per 1,000.

The 30% factor covers approximately 85% of the ratios experienced by the contributing companies in the five year age group cells with 25 or more claims, and about 65% of the cells in the 10 to 24 claim category. The combined proportion is of the order of 80%. There may be some question whether this goes far enough. Naturally there is room for judgment

TABLE 3

1959 ACCIDENTAL DEATH BENEFITS TABLE COMPARED WITH UNDERLYING  
EXPERIENCE TABLE AND 1926-33 INTERCOMPANY TABLE

AGE	1,000 $q_x^e$			MARGIN IN 1959 TABLE		RATIO OF 1959 TO 1926-33 TABLE	AGE	1,000 $q_x^e$			MARGIN IN 1959 TABLE		RATIO OF 1959 TO 1926-33 TABLE
	1959 Table	1951-56 Experience	1926-33 Table	Amount (1)-(2)	Percent-age (4)÷(2)			1959 Table	1951-56 Experience	1926-33 Table	Amount (1)-(2)	Percent-age (4)÷(2)	
1....	.551	.424	.875	.127	30%	63%	51....	.471	.362	.936	.109	30%	50%
2....	.451	.347	.860	.104	30	52	52....	.477	.367	.999	.110	30	48
3....	.398	.298	.845	.100	34	47	53....	.486	.374	1.050	.112	30	46
4....	.364	.264	.830	.100	38	44	54....	.498	.383	1.088	.115	30	46
5....	.339	.239	.815	.100	42	42	55....	.514	.395	1.115	.119	30	46
6....	.320	.220	.800	.100	45	40	56....	.532	.409	1.146	.123	30	46
7....	.307	.207	.767	.100	48	40	57....	.552	.425	1.180	.127	30	47
8....	.302	.202	.733	.100	50	41	58....	.575	.442	1.244	.133	30	46
9....	.298	.198	.699	.100	51	43	59....	.598	.460	1.310	.138	30	46
10....	.303	.203	.662	.100	49	46	60....	.624	.480	1.378	.144	30	45
11....	.312	.212	.644	.100	47	48	61....	.653	.502	1.448	.151	30	45
12....	.330	.230	.662	.100	43	50	62....	.686	.528	1.519	.158	30	45
13....	.360	.260	.796	.100	38	45	63....	.724	.557	1.589	.167	30	46
14....	.401	.301	.887	.100	33	45	64....	.766	.589	1.656	.177	30	46
15....	.476	.366	.882	.110	30	54	65....	.809	.622	1.720	.187	30	47
16....	.637	.490	.854	.147	30	75	66....	.853	.656	1.783	.197	30	48
17....	.723	.556	.827	.167	30	87	67....	.900	.692	1.844	.208	30	49
18....	.751	.578	.801	.173	30	94	68....	.949	.730	1.906	.219	30	50
19....	.758	.583	.776	.175	30	98	69....	1.002	.771	1.974	.231	30	51
20....	.748	.575	.752	.173	30	99	70....	1.065	.819	2.053	.246	30	52
21....	.720	.554	.728	.166	30	99	71....	1.141	.878	2.148	.263	30	53
22....	.675	.519	.697	.156	30	97	72....	1.238	.952	2.264	.286	30	55

TABLE 3—Continued

AGE	1,000 $q_x^2$			MARGIN IN 1959 TABLE		RATIO OF 1959 TO 1926-33 TABLE	AGE	1,000 $q_x^{ad}$			MARGIN IN 1959 TABLE		RATIO OF 1959 TO 1926-33 TABLE
	1959 Table	1951-56 Experience	1926-33 Table	Amount (1)-(2)	Percent- age (4)÷(2)			1959 Table	1951-56 Experience	1926-33 Table	Amount (1)-(2)	Percent- age (4)÷(2)	
	(1)	(2)	(3)	(4)	(5)			(1)	(2)	(3)	(4)	(5)	
23....	.612	.471	.654	.141	30%	94%	73....	1.360	1.046	2.409	.314	30%	56%
24....	.546	.420	.605	.126	30	90	74....	1.516	1.166	2.586	.350	30	59
25....	.490	.377	.555	.113	30	88	75....	1.710	1.315	2.801	.395	30	61
26....	.448	.345	.509	.103	30	88	76....	1.942	1.494	3.059	.448	30	63
27....	.424	.324	.473	.100	31	90	77....	2.214	1.703	3.362	.511	30	66
28....	.409	.309	.449	.100	32	91	78....	2.526	1.943	3.711	.583	30	68
29....	.400	.300	.439	.100	33	91	79....	2.881	2.216	4.100	.665	30	70
30....	.394	.294	.438	.100	34	90	80....	3.277	2.521	4.519	.756	30	73
31....	.390	.290	.447	.100	34	87	81....	3.708	2.852	4.956	.856	30	75
32....	.387	.287	.464	.100	35	83	82....	4.168	3.206	5.405	.962	30	77
33....	.386	.286	.481	.100	35	80	83....	4.584	3.584	5.867	1.000	28	78
34....	.386	.286	.494	.100	35	78	84....	4.988	3.988	6.363	1.000	25	78
35....	.386	.286	.502	.100	35	77	85....	5.419	4.419	6.926	1.000	23	78
36....	.387	.287	.511	.100	35	76	86....	5.878	4.878	7.585	1.000	21	77
37....	.389	.289	.523	.100	35	74	87....	6.367	5.367	8.364	1.000	19	76
38....	.391	.291	.544	.100	34	72	88....	6.886	5.886	9.270	1.000	17	74
39....	.393	.293	.571	.100	34	69	89....	7.437	6.437	10.278	1.000	16	72
40....	.395	.295	.598	.100	34	66	90....	8.022	7.022	11.344	1.000	14	71
41....	.399	.299	.621	.100	33	64	91....	8.642	7.642	12.411	1.000	13	70
42....	.405	.305	.637	.100	33	64	92....	9.298	8.298	13.408	1.000	12	69
43....	.413	.313	.649	.100	32	64	93....	9.991	8.991	14.259	1.000	11	70
44....	.422	.322	.660	.100	31	64	94....	10.723	9.723	14.892	1.000	10	72
45....	.431	.331	.675	.100	30	64	95....	11.495	10.495	15.265	1.000	10	75
46....	.441	.339	.696	.102	30	63	96....	12.308	11.308	15.450	1.000	9	80
47....	.450	.346	.726	.104	30	62	97....	13.164	12.164	15.590	1.000	8	84
48....	.456	.351	.765	.105	30	60	98....	14.064	13.064	15.710	1.000	8	90
49....	.462	.355	.815	.107	30	57	99....	15.009	14.009	15.820	1.000	7	95
50....	.465	.358	.873	.107	30	53							

TABLE 4

1959 ACCIDENTAL DEATH BENEFITS TABLE COMBINED WITH 1958 CSO COMMUTATION FUNCTIONS

AGE	1000 $q_x^{a,d}$	INTEREST @ 2½%		INTEREST @ 3%		AGE	1000 $q_x^{a,d}$	INTEREST @ 2½%		INTEREST @ 3%	
		1000 C	1000 $M_x^{a,d}$	1000 $C_x^{a,d}$	1000 $M_x^{a,d}$			1000 $C_x^{a,d}$	1000 $M_x^{a,d}$	1000 $C_x^{a,d}$	1000 $M_x^{a,d}$
1	.551	5 207 366	160 579 354	5 156 932	136 903 884	51	.471	1 133 365	41 521 884	879 985	29 441 984
2	.451	4 151 014	155 371 988	4 090 855	131 746 952	52	.477	1 109 606	40 388 519	857 356	28 561 999
3	.398	3 568 422	151 220 974	3 499 635	127 656 097	53	.486	1 091 983	39 278 913	839 642	27 704 643
4	.364	3 179 334	147 652 552	3 102 911	124 156 462	54	.498	1 079 766	38 186 930	826 218	26 865 001
5	.339	2 884 710	144 473 218	2 801 702	121 053 551	55	.514	1 074 336	37 107 164	818 073	26 038 783
6	.320	2 653 028	141 588 508	2 564 179	118 251 849	56	.532	1 070 735	36 032 828	811 373	25 220 710
7	.307	2 479 942	138 935 480	2 385 254	115 687 670	57	.552	1 068 489	34 962 093	805 740	24 409 337
8	.302	2 377 052	136 455 538	2 275 194	113 302 416	58	.575	1 068 989	33 893 604	802 204	23 603 597
9	.298	2 285 544	134 078 486	2 176 988	111 027 222	59	.598	1 066 194	32 824 615	796 222	22 801 393
10	.303	2 264 468	131 792 942	2 146 443	108 850 234	60	.624	1 065 237	31 758 421	791 646	22 005 171
11	.312	2 272 106	129 528 474	2 143 227	106 703 791	61	.653	1 065 433	30 693 184	787 948	21 213 525
12	.330	2 341 690	127 256 368	2 198 142	104 560 564	62	.686	1 067 691	29 627 751	785 785	20 425 577
13	.360	2 489 125	124 914 678	2 325 196	102 362 422	63	.724	1 072 625	28 560 060	785 584	19 639 792
14	.401	2 701 413	122 425 553	2 511 254	100 037 226	64	.766	1 077 752	27 487 435	785 508	18 854 208
15	.476	3 124 105	119 724 140	2 890 093	97 525 972	65	.809	1 078 242	26 409 683	782 050	18 068 700
16	.637	4 072 862	116 600 035	3 749 493	94 635 879	66	.853	1 073 941	25 331 441	775 149	17 286 650
17	.723	4 503 035	112 527 173	4 125 389	90 886 386	67	.900	1 067 073	24 257 500	766 454	16 511 501
18	.751	4 555 950	108 024 138	4 153 605	86 760 997	68	.949	1 055 969	23 190 427	754 796	15 745 047
19	.758	4 478 678	103 468 188	4 063 335	82 607 392	69	1.002	1 042 412	22 134 458	741 488	14 990 251
20	.748	4 304 295	98 989 510	3 886 167	78 544 057	70	1.065	1 031 628	21 092 046	730 255	14 248 763
21	.720	4 034 883	94 685 215	3 625 243	74 657 890	71	1.141	1 024 601	20 060 418	721 761	13 518 508
22	.675	3 683 689	90 650 332	3 293 636	71 032 647	72	1.238	1 025 861	19 035 817	719 140	12 796 747
23	.612	3 252 357	86 966 643	2 893 860	67 739 011	73	1.360	1 034 985	18 009 956	722 013	12 077 607
24	.546	2 825 491	83 714 286	2 501 843	64 845 151	74	1.516	1 054 361	16 974 971	731 960	11 355 594



TABLE 4—Continued

AGE	1000 $q_{x}^{d}$	INTEREST @ 2½%		INTEREST @ 3%		AGE	1000 $q_{x}^{d}$	INTEREST @ 2½%		INTEREST @ 3%	
		1000 $C_{x}^{d}$	1000 $M_{x}^{d}$	1000 $C_{x}^{e}$	1000 $M_{x}^{e}$			1000 $C_{x}^{d}$	1000 $M_{x}^{d}$	1000 $C_{x}^{d}$	1000 $M_{x}^{d}$
25.....	.490	2 469 126	80 888 795	2 175 684	62 343 308	75.....	1.710	1 081 241	15 920 610	746 976	10 623 634
26.....	.448	2 198 175	78 419 669	1 927 532	60 167 624	76.....	1.942	1 110 091	14 839 369	763 185	9 876 658
27.....	.424	2 025 696	76 221 494	1 767 666	58 240 092	77.....	2.214	1 136 940	13 729 278	777 849	9 113 473
28.....	.409	1 902 579	74 195 798	1 652 172	56 472 426	78.....	2.526	1 157 066	12 592 338	787 776	8 335 624
29.....	.400	1 811 645	72 293 219	1 565 569	54 820 254	79.....	2.881	1 167 676	11 435 272	791 139	7 547 848
30.....	.394	1 737 325	70 481 574	1 494 056	53 254 685	80.....	3.277	1 164 662	10 267 596	785 268	6 756 709
31.....	.390	1 674 170	68 744 249	1 432 755	51 760 629	81.....	3.708	1 144 296	9 102 934	767 790	5 971 441
32.....	.387	1 617 223	67 070 079	1 377 302	50 327 874	82.....	4.168	1 105 114	7 958 638	737 902	5 203 651
33.....	.386	1 570 161	65 452 856	1 330 730	48 950 572	83.....	4.584	1 032 603	6 853 524	686 136	4 465 749
34.....	.386	1 528 310	63 882 695	1 288 974	47 619 842	84.....	4.988	943 413	5 820 921	623 829	3 779 613
35.....	.386	1 487 456	62 354 385	1 248 427	46 330 868	85.....	5.419	849 932	4 877 508	559 288	3 155 784
36.....	.387	1 451 284	60 866 929	1 212 155	45 082 441	86.....	5.878	754 500	4 027 576	494 083	2 596 496
37.....	.389	1 419 447	59 415 645	1 179 809	43 870 286	87.....	6.367	659 540	3 273 076	429 797	2 102 413
38.....	.391	1 388 049	57 996 198	1 148 111	42 690 477	88.....	6.886	567 070	2 613 536	367 746	1 672 616
39.....	.393	1 357 024	56 608 149	1 117 000	41 542 366	89.....	7.437	479 052	2 046 466	309 163	1 304 870
40.....	.395	1 326 339	55 251 125	1 086 443	40 425 366	90.....	8.022	397 022	1 567 414	254 975	995 707
41.....	.399	1 302 479	53 924 786	1 061 719	39 338 923	91.....	8.642	322 081	1 170 392	205 839	740 732
42.....	.405	1 284 866	52 622 307	1 042 278	38 277 204	92.....	9.298	254 992	848 311	162 173	534 893
43.....	.413	1 272 959	51 337 441	1 027 606	37 234 926	93.....	9.991	196 223	593 319	124 189	372 720
44.....	.422	1 263 226	50 064 482	1 014 799	36 207 320	94.....	10.723	146 021	397 096	91 968	248 531
45.....	.431	1 252 507	48 801 256	1 001 303	35 192 521	95.....	11.495	104 363	251 075	65 410	156 563
46.....	.441	1 243 620	47 548 749	989 372	34 191 218	96.....	12.308	70 726	146 712	44 118	91 153
47.....	.450	1 230 831	46 305 129	974 445	33 201 846	97.....	13.164	44 244	75 986	27 453	47 035
48.....	.456	1 209 083	45 074 298	952 580	32 227 401	98.....	14.064	23 586	31 742	14 569	19 582
49.....	.462	1 186 808	43 865 215	930 491	31 274 821	99.....	15.009	8 156	8 156	5 013	5 013
50.....	.465	1 156 523	42 678 407	902 346	30 344 330						

here, but considering the requirements of companies with a favorable experience as well as the others and not overlooking the supplementary nature of the benefit, the 30% addition appeared to us to be justified. A uniform percentage loading was adopted rather than one varying by age since the data in Table 1 indicated that the median and quartile ratios were reasonably uniform by age group.

The .10 per 1,000 minimum was deemed advisable to avoid negligible additions to the basic experience. It was recognized also that in the area where the minimum is effective—when the basic rate is less than .333 per 1,000—greater percentage fluctuations can be expected. The ages where the minimum comes into play are 3 to 14 and 27 to 45, inclusive.

The 1.00 per 1,000 maximum is controlling when the basic rate is 3.333 or higher. This happens above age 82 and therefore is of no practical effect for companies with a maximum coverage age of 65 or 70. The graduated rates in Table 3 of the report are based on company experience up to age 82, and thereafter are a blend from company experience to an assumed terminal rate, based on population data, of 15 per 1,000 at age 100. Because of the nature of the death rates at the high ages, a 30% margin was not deemed necessary or desirable, and the 1.00 per 1,000 maximum was adopted as a practical method of grading the percentage down as the claim rate rose.

#### 1959 ACCIDENTAL DEATH BENEFITS TABLE

The claim rates recommended for the 1959 Accidental Death Benefits Table appear in Table 3. Also shown in this table are the 1951–56 graduated experience rates, and the margins in the new table in relation to these rates. Table 3 includes in addition the 1926–33 Intercompany Table rates and the ratio of the new table to these rates.

Table 4 contains commutation functions based on the proposed 1959 Accidental Death Benefits Table combined with the 1958 CSO Table and with interest at  $2\frac{1}{2}\%$  and  $3\%$ . The payment of claims at the end of the year of death was assumed.

Net annual premiums based on the commutation functions in Table 4 are presented in Table 5 for the Ordinary Life, 20 Payment Life and 20 Year Endowment plans at selected issue ages. The form of coverage for which the premiums are calculated is that which ceases at age 65. The limited range within which these net premiums fall is noteworthy. Separate tests indicated that if the proposed 1959 Accidental Death Benefits Table had been combined with the 1941 CSO Table, the resulting net premiums would have been very similar to those in Table 5.

For comparison purposes Table 5 also shows the net annual premiums based on the 1926-33 Intercompany Table in combination with the 1941 CSO Table. The ratios of the net premiums based on the 1959 Table to those based on the 1926-33 Table evidence a percentage reduction which ranges from about 30% or 35% at the young ages to about 50% at the older ages.

To gauge the impact of the new table on reserve levels, Table 6 has

TABLE 5

NET ANNUAL PREMIUM PER \$1,000 OF ACCIDENTAL DEATH BENEFIT  
1959 ACCIDENTAL DEATH BENEFITS TABLE WITH 1958 CSO TABLE  
COMPARED WITH 1926-33 INTERCOMPANY TABLE WITH 1941 CSO TABLE  
COVERAGE CEASING AT AGE 65

ISSUE AGE	INTEREST @ 2½%			INTEREST @ 3%		
	1959 Table	1926-33 Table	Ratio	1959 Table	1926-33 Table	Ratio
ORDINARY LIFE						
5.....	.450	.709	63%	.445	.702	63%
15.....	.505	.700	72	.506	.690	73
25.....	.437	.678	64	.432	.661	65
35.....	.456	.808	56	.450	.793	57
45.....	.511	1.015	50	.506	1.002	50
55.....	.598	1.300	46	.594	1.292	46
20 PAYMENT LIFE						
5.....	.857	1.324	65%	.799	1.237	65%
15.....	.881	1.195	74	.842	1.126	75
25.....	.673	1.023	66	.644	.967	67
35.....	.590	1.031	57	.573	.995	58
45.....	.511	1.015	50	.506	1.002	50
55.....	.598	1.300	46	.594	1.292	46
20 YEAR ENDOWMENT						
5.....	.462	.736	63%	.455	.733	62%
15.....	.542	.624	87	.542	.625	87
25.....	.397	.506	78	.395	.503	79
35.....	.414	.673	62	.411	.666	62
45.....	.511	1.015	50	.506	1.002	50
55.....	.598	1.300	46	.594	1.292	46

TABLE 6  
 MEAN RESERVES PER \$1,000 OF ACCIDENTAL DEATH BENEFIT  
 1959 ACCIDENTAL DEATH BENEFITS TABLE WITH 1958 CSO 2½%  
 COMPARED WITH 1926-33 INTERCOMPANY TABLE WITH 1941 CSO 2½%  
 COVERAGE CEASING AT AGE 65

POLICY YEAR	ISSUE AGE					
	5	15	25	35	45	55
ORDINARY LIFE						
1959 ACCIDENTAL DEATH BENEFITS TABLE						
1.....	.29	.27	.22	.27	.30	.35
2.....	.42	.25	.22	.35	.39	.44
5.....	.91	.25	.26	.60	.63	.62
10.....	1.70	.25	.57	1.00	.96	.38
20.....	.22	.25	1.29	1.41	.38	.....
1926-33 INTERCOMPANY TABLE						
1.....	.36	.35	.41	.57	.69	.76
2.....	.36	.35	.57	.90	1.06	.97
5.....	.36	.35	1.30	1.85	2.03	1.40
10.....	.36	.35	2.71	3.21	2.81	.81
20.....	.36	2.29	5.03	4.46	.81	.....
RATIO OF 1959 TABLE TO 1926-33 TABLE						
1.....	81%	77%	54%	47%	43%	46%
2.....	117	71	39	39	37	45
5.....	253	71	20	32	31	44
10.....	472	71	21	31	34	47
20.....	61	11	26	32	47	.....
20 PAYMENT LIFE						
1959 ACCIDENTAL DEATH BENEFITS TABLE						
1.....	.70	.65	.44	.40	.30	.35
2.....	1.26	1.01	.66	.63	.39	.44
5.....	3.09	1.61	1.52	1.32	.63	.62
10.....	6.35	2.93	3.28	2.55	.96	.38
20.....	10.67	9.15	7.60	5.15	.38	.....

TABLE 6—Continued

POLICY YEAR	20 PAYMENT LIFE—Continued					
	ISSUE AGE					
	5	15	25	35	45	55
	1926-33 INTERCOMPANY TABLE					
1 .....	.93	.77	.76	.79	.69	.76
2 .....	1.49	1.13	1.29	1.35	1.06	.97
5 .....	3.44	2.45	3.16	3.05	2.03	1.40
10 .....	7.26	5.47	6.71	5.82	2.81	.81
20 .....	15.90	15.55	14.52	10.93	.81	.....
	RATIO OF 1959 TABLE TO 1926-33 TABLE					
1 .....	75%	84%	58%	51%	43%	46%
2 .....	85	89	51	47	37	45
5 .....	90	66	48	43	31	44
10 .....	87	54	49	44	34	47
20 .....	67	59	52	47	47	.....
	20 YEAR ENDOWMENT					
	1959 ACCIDENTAL DEATH BENEFITS TABLE					
1 .....	.30	.31	.20	.23	.30	.35
2 .....	.44	.31	.20	.26	.39	.44
5 .....	.98	.27	.20	.38	.63	.62
10 .....	1.84	.27	.20	.51	.96	.38
20 .....	.27	.27	.21	.24	.38	.....
	1926-33 INTERCOMPANY TABLE					
1 .....	.37	.31	.26	.43	.69	.76
2 .....	.37	.31	.26	.62	1.06	.97
5 .....	.37	.31	.38	1.12	2.03	1.40
10 .....	.52	.31	.73	1.62	2.81	.81
20 .....	.37	.31	.32	.53	.81	.....
	RATIO OF 1959 TABLE TO 1926-33 TABLE					
1 .....	81%	100%	77%	53%	43%	46%
2 .....	119	100	77	42	37	45
5 .....	265	87	53	34	31	44
10 .....	354	87	27	31	34	47
20 .....	73	87	66	45	47	.....

been compiled, showing mean reserves under the proposed table and the 1926-33 Table for the Ordinary Life, 20 Payment Life and 20 Year Endowment plans at the specimen issue ages and selected durations. This calculation has been confined to a  $2\frac{1}{2}\%$  interest rate. The new table will require reserves that in the aggregate are less than 50% of the reserves under the 1926-33 Table. This sharp percentage reduction is a reflection of the fact that the accidental death rates do not increase by age nearly as rapidly in the new table as in the old.

## DISCUSSION OF PRECEDING PAPER

ROLAND F. DORMAN:

The substantial improvement in accidental death rates since the 1926-1933 study was completed indicates the need for a new valuation standard for accidental death benefits. The 1951-1956 Experience Table is the logical starting point in the development of a table to serve as a valuation standard. There would seem to be no question that a table for use on an industry-wide basis should include margins over the 1951-1956 experience rates. The main question, of course, is how large the margins should be. Certainly, the margins should be sufficient to cover the experience of a large portion of individual company variations from the average but should not be so large as to be unrealistic for those companies with good experience. I feel the margins in the 1959 Accidental Death Benefits Table satisfy this requirement. This would seem to be an appropriate time to adopt a new valuation standard for accidental death coverages in view of the fact that the 1958 CSO Table is currently being processed through the various jurisdictions.

It is interesting to note that the 1951-1956 experience indicates a higher death rate is experienced on the larger amounts of accidental death coverage. The current trend toward issuing large amounts of accidental death coverage, underwriting more liberally, together with changes in the definition of benefits, and the likelihood of further liberalization in interpretation by the courts, may very well lead to a reversal of past improvement in accidental death rates. We should, therefore, add adequate margins to the basic experience rates if premiums are to be based on them.

Messrs. Brodie and November have performed a valuable service by preparing the 1959 Accidental Death Benefits Table.

### (AUTHORS' REVIEW OF DISCUSSION)

NORMAN BRODIE AND WILLIAM J. NOVEMBER:

We should like to thank Mr. Dorman for discussing our paper and endorsing our suggested valuation standard. It may be of interest to note that the 1926-33 Intercompany Double Indemnity Table is specified as the minimum valuation standard for accidental death benefits in the laws of 32 of the 50 states. Of the other 18 states, 13 have no applicable law and 5 have provisions such as "any recognized basis satisfactory to Commissioner."