TRANSACTIONS OF SOCIETY OF ACTUARIES 1977 REPORTS

II. EXPERIENCE UNDER ACCIDENTAL DEATH BENEFIT PROVISIONS IN ORDINARY INSURANCE POLICIES BETWEEN 1970 AND 1975 ANNIVERSARIES

THE 1959 Intercompany Accidental Death Benefits Table (TSA, XI, 754), currently in use, was developed from the combined experience of seventeen companies during the period from 1951 to 1956 policy anniversaries (TSA, 1958 Reports, p. 45). This experience is now more than twenty years old. Since it was presumed that accidental death rates have changed greatly since then, a new investigation was undertaken to examine the experience under accidental death benefit (ADB) clauses included in Ordinary insurance policies.

Data for the current study have been furnished by the fifteen companies listed in Table 1, which also shows the percentages of the total exposure (by amounts of insurance) that were contributed by each company.

SCOPE OF THE STUDY

Years of Issue

Each company's contribution was based on as many years of issue as possible.

Period of Observation

The period of observation was between 1970 and 1975 policy anniversaries, thus providing a sufficient volume of data to give significant results.

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Other Features of the Data

Further details regarding the data furnished are in the specifications of the study (Appendix II) as well as in the supplementary specifications for the study that were mailed at a later date (Appendix III). The following points may be of special interest:

- The investigation was confined to ADB clauses issued at standard rates.
- Accidental death benefits automatically incorporated in life insurance policies were included, but the data for such benefits were also studied separately.
- 3. The actual amount of ADB coverage on each policy, whether equal to or some multiple of the policy's face amount of life insurance, was used in determining the exposures of this study, and the actual amount of ADB paid (whether the full amount or a compromised amount) was used in determining the benefits paid.
- 4. The experience under a particular type of "triple indemnity" benefit that pays twice the usual ADB if death is the result of riding as a passenger in a public conveyance was obtained separately. If such triple indemnity amount was paid, the usual ADB amount was counted in the basic study, while the extra "public conveyance" amount was counted only in the special, separate study. (However,

because of the small volume of data contributed to this separate study, no detailed results of the study are presented in this report.)

5. Benefits added after issue were also included.

Information was obtained from each company as to the exclusions contained in its ADB clauses. This information is summarized later in the report. Also, variations in experience among the individual companies have been analyzed, but no attempt was made to separate the experience of companies according to the liberality of their policy language or of their administration.

Volume of Data

As indicated at the bottom of Table 1, for all years of issue combined there were 27,584 paid claims for \$205 million on exposures of \$483 billion. The previous intercompany investigation included 16,348 paid claims for \$51 million on exposures of \$138 billion.

TABLE 1 LIST OF CONTRIBUTING COMPANIES AND PROPORTION OF TOTAL ADB EXPOSURES CONTRIBUTED BY EACH COMPANY

· · · · · · · · · · · · · · · · · · ·		-	
Company		Proportion of Exposu	
Prudential		36.4%	6
New York Life		15.8	*
John Hancock		12.7	
Equitable, New York		6.9	t
Northwestern Mutual		5.8	
Mutual of New York		5.4	
Massachusetts Mutual		3.0	
Travelers	, , .	2.7	
Connecticut Mutual		2.2	
Penn Mutual		2.1	
Bankers Life	,	2.0	
National Life and Accident		1.8	
Mutual Benefit		1.3	
Franklin Life		1.0	
Sun Life		0.9	
Total exposures \$482,807,527,	000	100.0%	- 0

Total ADB paid claims:

Number of policies.... 27,584

^{*} Contributed experience only for experience years between 1972 and 1975 anni-

[†] Contributed experience only for experience years between 1973 and 1975 anni-

RESULTS OF THE INVESTIGATION

Aggregate Experience

Table 2 summarizes the data of the present investigation by attained-age group and relates the actual ADB claims paid to the claims paid that would have been expected on the basis of the graduated 1951-56 ADB experience rates (TSA, 1958 Reports, p. 50). All policy years of experience and both sexes have been combined.

Table 2 shows a mortality ratio of 116 percent by amount for all attained-age groups combined, indicating an overall increase in the ADB

TABLE 2

ORDINARY ACCIDENTAL DEATH BENEFITS

EXPERIENCE BETWEEN 1970 AND 1975 POLICY ANNIVERSARIES
RELATIVE TO 1951-56 GRADUATED EXPERIENCE

ALL ISSUE YEARS, ALL POLICY YEARS, BOTH SEXES COMBINED

	F	Actual	L CLAIMS PAID	MORTALITY
ATTAINED AGES	EXPOSURE (000)	Number of Policies	Amount Paid	RATIO BY AMOUNT PAID
-4	\$ 915,694	31	\$ 192.949	63%
_9	6,026,037	162	678,636	54
0-14	8,761,103	294	1,551,509	73
5-19	20,714,497	2,265	14,127,177	126
20–24	57,734,684	4,570	34,359,059	120
5-29	77,646,935	3,550	30,368,349	118
0-34	70,099,262	2.857	25,053,172	124
35–39	59,914,752	2,394	21,347,452	123
10-44	53,975,859	2,372	22,021,491	133
15–49	47,946,854	2,351	19,148,576	116
60-54	35,907,655	1,949	13,917,142	105
55–59	23,287,273	1,622	9,919,130	101
0-64	13,251,418	1,369	6,489,235	93
55–69	4,425,146	623	2,429,689	80
0-74	962,261	283	712,887	78
5-79	668,070	299	876,344	77
0-84	389,014	290	840,005	69
35–89	145,188	228	665,466	89
00-94	33,858	63	180,276	68
05-99	1,967	12	32,373	153
Under 35	\$241,898,212	13,729	\$106,330,851	119%
35– <u>4</u> 4	113,890,611	4,766	43,368,943	128
15-54	83,854,509	4,300	33,065,718	111
55 and over	43,164,195	4,789	22,145,405	92
All ages	\$482,807,527	27,584	\$204,910,917	116%

paid claim rate from the 1951-56 period to the 1970-75 period. However, there is considerable variation by attained-age group. The experience has improved at the young ages (1-14); worsened for the teens and middle ages (15-54), where the volume of claims is significant; and improved at the older ages (60 and over).

Graduated Claim Rates

To facilitate the analysis of the data in the various subdivisions of the study, graduated paid claim rates by amount were derived and are presented in Table 3. They are based on the total contribution covering all policy years, and thus form an aggregate table. Population data were used as the basis for extending the graduated rates to attained ages 1–4 and 92–100 because of the small amount of ADB data at these ages.

Also shown in Table 3, for comparison, are the graduated rates from the 1951-56 experience.

The graduation process and the method of extension are described in section 1 of Appendix I. Table 4 summarizes the relationship of the actual experience to the graduated rates shown in detail in Table A.

The graduated aggregate paid claim rates for the present study were produced for analytical purposes only. They are not intended to be used for premium calculations or valuations. They have no loading for fluctuations or contingencies. Also, there were significant variations in the experience among the contributing companies (as indicated in Table 14), which indicates that distributions of exposures and other characteristics peculiar to individual companies would have to be considered in pricing and valuation.

Causes of Accidental Death

The companies were requested to give the cause of death on each ADB claim card. The cause groups studied were derived from the 1970 Code for Cause of Death (see TSA, 1969 Reports, p. 1). The cause groups and the corresponding committee code numbers used are shown in Appendix II. For convenience, the equivalent codes of the Eighth Revision of the International List of Diseases and Causes of Death are also shown. Twelve companies contributed to this portion of the study.

The distribution of the amounts of claims by cause of accidental death for the four attained-age groups and for all attained ages combined appears in Table 5. Suicide and injuries resulting from operations of war are excluded by all of the contributing companies; the claims due to these causes shown in Table 5 are the results of compromise settlements.

Motor vehicle accidents are by far the most important cause, account-

TABLE 3 GRADUATED 1970-75 ADB PAID CLAIM RATES COMPARED TO GRADUATED 1951-56 RATES

(Aggregate Experience Based on Amount of Claims Paid)

ATTAINED AGE		NIM RATE 1,000	RATIO OF 1970-75	ATTAINED AGE	PAID CLA		RATIO OF 1970-75
AGE	1970-75	1951-56	то 1951-56	AGE	1970-75	1951-56	то 1951-56
1	.480	. 424	113%	51	.396	.362	109%
2	. 383	.347	110	52	. 398	. 367	108
3	. 301	. 298	101	53	. 401	.374	107
4	. 234	. 264	89	54	. 406	.383	106
5	. 181	. 239	76	55	. 412	. 395	104
6	. 141	. 220	64	56	.416	. 409	102
7	. 113	. 207	55	57	.418	. 425	98
8	. 097	. 202	48	58	. 421	. 442	95
9	. 093	. 198	47	59	. 431	. 460	94
10	. 100	203	49	60	. 446	. 480	93
11	.120	.212	57	61	. 464	. 502	92
12	156	. 230	68	62	. 484	. 528	92
13	219	260	84	63	500	. 557	90
14	.313	. 301	104	64	. 512	. 589	87
15	. 432	. 366	118	65	. 524	. 622	84
16	. 557	490	114	66	. 539	. 656	82
17	. 663	. 556	119	67	. 556	.692	80
18	. 732	. 578	127	68	.578	. 730	79
19	. 757	. 583	130	69	.613	,771	80
20	. 739	. 575	129	70	.660	. 819	81
21	. 688	. 554	124	71	.721	.878	82
22	.619	. 519	119	72	792	.952	83
23	. 548	.471	116	73	.869	1.046	83
24	. 485	.420	115	74	.962	1.166	83
25	.436	.377	116	75	1.082	1.315	82
26	.402	.345	117	76	1.218	1.494	82
27	.381	.324	118	77	1.354	1.703	80
28	.369	.309	119	78	1.491	1.943	77
29	.362	.300	121	79	1.623	2.216	73
30	.360	. 294	122	80	1.756	2.521	70
31	.360	290	124	81.	1 906	2.852	67
32	.361	. 287	126	82	2.139	3.206	67
33	.363	. 286	127	83	2.537	3.584	71
34	.363	286	127	84	3.104	3.988	78
35	.359	.286	126	85	3.711	4.419	84
36	354	. 287	123	86	4.209	4.878	86
37	.348	. 289	120	87	4.544	5.367	85
38	.350	.291	120	88	4.787	5.886	81
39	.359	293	123	89	5.002	6.437	78
40	.374	295	127	90	5.176	7.022	74
41	.393	299	131	91	5.276	7.642	69
42	.410	.305	134	92	5.357	8.298	65
43	.420	.313	134	93	5.476	8.991	61
44	421	.322	131	94.	5.687	9.723	58
45	415	.331	125	95	6.046	10.495	58
46	.406	.339	120	96	6.608	11.308	58
47	.399	.346	115	97	7.429	12.164	61
48	.396	.351	113	98	8.564	13.064	66
49	394	.355	111	99	10.069	14.009	72
50	.394	.358	110	100	12.000	15.000	80
50		.556	110	100	12.000	15.00	30

TABLE 4

AGGREGATE 1970-75 ADB EXPERIENCE IN
RELATION TO GRADUATED 1970-75 ADB
RATES IN TABLE 3
ALL ISSUE YEARS COMBINED,
BOTH SEXES COMBINED
(See Also Table B)

Attained Ages	ADB Mortality Ratio by Amount
Under 35	100%
35-44	101
45-54	98
55 and over	101
All ages	100%

ing for 50.0 percent of the paid claims when all ages are considered together. Homicides come next in order, representing 9.8 percent of the total paid claims. Drownings account for 6.6 percent of the claims. No other cause produces as much as 5 percent of the claims for all ages combined.

Motor vehicle accidents comprise 57 percent of the paid claims at ages under 35, but less than 44 percent at higher ages. The proportion due to accidental falls increases with age, rising to 17 percent for ages 55 and over. Deaths due to aircraft accidents and homicide take a heavier toll in the middle-age range of 35-54 than at the low and high ages.

Comparison with the 1951-56 experience (TSA, 1958 Reports, p. 53) reveals that homicides represented only 3 percent of the claims then as compared with 10 percent in the current study, while motor vehicle accidents are down from 55 percent to 50 percent. Accidental falls are down 4 percentage points, and accidental drownings are up about 2 percentage points.

Table 6 gives the distribution of the amounts of claims by cause of accidental death for each policy year in the study. This table shows the decrease in the relative importance of motor vehicle accidents beginning in the 1973–74 policy year when the gasoline shortage occurred and highway speed limits were lowered. Motor vehicle accidents accounted for 55 percent of the claims in the policy year 1971–72, declined slightly in 1972–73 to 53 percent, and declined in 1973–74 to 45 percent. However, in the 1974–75 policy year the percentage rose to 47 percent.

Homicide deaths showed an increase from 8 percent in 1970-71 to 11 percent in 1974-75. The percentages of deaths from most other causes increased slightly.

TABLE 5

DISTRIBUTION BY CAUSE OF DEATH AND ATTAINED-AGE GROUP
AGGREGATE EXPERIENCE OF TWELVE COMPANIES
BASED ON AMOUNTS OF ADB CLAIMS PAID*

		A	TTAINED AGE	s	
CAUSE OF DEATH (SEE APPENDIX II)	Under 35	35-44	45-54	55 and Over	All
			age Distribu of ADB Cla		
Motor vehicle accident Homicide Accidental drowning and sub-	57.3% 7.9	43.5% 13.5	42.4% 13.1	37.0% 7.0	50.0% 9.8
mersion	6.4 2.3 3.5	6.1 4.2 6.3	6.9 6.1 4.5	8.1 17.3 2.1	6.6 4.8 4.1
Accident caused by fire, explosion, etc.	2.8	4.2	4.6	4.6	3.5
Accident caused by firearm weapon Accidental poisoning Suicide	2.5 2.0 0.5	3.2 2.4 0.5	2.6 1.1 0.5	2.8 2.3 1.1	2.7 2.0 0.6
Injury resulting from opera- tions of war All other claims	0.1 14.7	0.4 15.7	0.1 18.1	0.3 17.4	0.2 15.7
All causes	100.0%	100.0%	100.0%	100.0%	100.0%
			of ADB Cla 1 \$1,000 Uni		
Motor vehicle accident	\$ 58,265 7,987	\$17,336 5,360	\$12,578 3,875	\$ 7,231 1,361	\$ 95,410 18,583
Accidental drowning and sub- mersion	6,529 2,304 3,542	2,434 1,676 2,525	2,055 1,806 1,352	1,589 3,383 408	12,607 9,169 7,827
Accident caused by fire, explosion, etc.	2,822	1,661	1,373	895	6,751
Accident caused by firearm weapon. Accidental poisoning. Suicide. Injury resulting from opera-	2,550 2,042 479	1,259 969 187	765 338 151	549 446 224	5,123 3,795 1,041
tions of war	110 14,961	165 6,249	20 5,360	54 3,402	349 29,972
All causes	\$101,591	\$39,821	\$29,673	\$19,542	\$190,627

^{*} Some companies contributed for only a portion of the five-year period.

TABLE 6

DISTRIBUTION BY CAUSE OF DEATH AND EXPERIENCE PERIOD AGGREGATE EXPERIENCE OF TWELVE COMPANIES BASED ON AMOUNTS OF ADB CLAIMS PAID*

C		_	Experien	CE PERIOD		
CAUSE OF DEATH	1970-71	1971-72	1972-73	1973-74	1974-75	All
				Distribution OB Claims		
Motor vehicle accident	53.4% 8.1	55.3% 8.2	53.4% 8.4	44.9% 11.4	46.9% 11.3	50.0% 9.8
Accidental drowning and submersion	6.8 4.4 3.7	5.4 4.5 3.7	6.5 4.1 3.4	7.3 5.5 4.8	6.6 5.2 4.5	6.6 4.8 4.1
Accident caused by fire, explosion, etc	4.3	3.2	3.4	2.9	4.1	3.5
Accident caused by firearm weapon	2.6 1.8 0.3	2.4 1.8 0.3	2.1 2.4 .5	2.9 1.8 0.9	3.3 2.1 0.5	2.7 2.0 0.6
Injury resulting from opera- tions of war All other claims	0.3 14.3	0.1 15.1	0.0 15.8	0.3 17.3	0.2 15.3	0.2 15.7
All causes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		Am	ount of AD (in \$1,000	B Claims I Units)	Paid	<u>' </u>
Motor vehicle accident Homicide Accidental drowning and	\$14,257 2,155	\$15,617 2,328	\$22,943 3,619	\$20,431 5,159	\$22,162 5,322	\$ 95,410 18,583
submersionAccidental fallAircraft accident	1,821 1,180 972	1,531 1,273 1,048	2,789 1,775 1,485	3,328 2,504 2,198	3,138 2,437 2,124	12,607 9,169 7,827
Accident caused by fire, explosion, etc	1,148	911	1,450	1,316	1,926	6,751
Accident caused by firearm weapon. Accidental poisoning	703 475 85	662 514 71	891 1,012 210	1,309 820 417	1,558 974 258	5,123 3,795 1,041
Injury resulting from operations of warAll other claims	78 3,813	24 4,263	15 6,802	125 7,879	107 7,215	349 29,972
All causes	\$ 26,687	\$28,242	\$42,991	\$ 45,486	\$47,221	\$190,627

^{*}Some companies contributed for only a portion of the five-year period.

Analysis by Policy Year

For policy years 1, 2, and 3 separately and for policy years 4 and later combined, Table 7 shows mortality ratios by amounts of insurance for the experience of fourteen of the fifteen contributing companies in relation to the 1970–75 graduated claim rates of Table 3. These ratios are shown for each of several attained-age groups.

Although the overall ratio by amount for policy year 1 is 101 percent,

TABLE 7

ANALYSIS BY POLICY YEAR AND ATTAINED-AGE GROUP
EXPERIENCE OF FOURTEEN COMPANIES, ALL ISSUE YEARS
MORTALITY RATIOS BASED ON ADB RATES BY AMOUNT OF INSURANCE
RELATIVE TO GRADUATED 1970-75 ADB RATES IN TABLE 3

Policy			ATTAINED AGES							
YEAR	Under 35	35-44	45-54	55 and Over	All					
	.)	fortality Ratios	by Amount of A	ADB Claims Paid	d					
1	97% 97 104 100	113°7 138 125 96	123% 108 87 97	134% 61 170 100	101% 103 108 99					
All policy years .	100%	102%	98%	101%	100%					
-		Numb	er of ADB Clain	ns Paid	1					
1	2,191 1,603 1,448 8,279	251 217 221 4,011	109 107 115 3,855	21 21 46 4,631	2,572 1,948 1,830 20,776					
All policy years	13,521	4,700	4,186	4,719	27,126					
	Amount of ADB Claims Paid									
1	\$ 20,932,024 14,992,189 12,687,194 55,844,510	3,942,017 3,403,850	\$ 1,639,728 1,445,290 1,206,370 27,858,320	\$ 357,557 194,280 651,715 20,547,053	\$ 26,467,785 20,573,776 17,949,129 135,975,183					
All policy years	\$ 104,455,917	\$42,609,643	\$32,149,708	\$21,750,605	\$200,965,873					

ages under 35 show a 97 percent ratio while age groups 35-44, 45-54, and 55 and over have ratios of 113, 123, and 134 percent, respectively. In the 1951-56 study, the overall ratio for policy year 1 was 107 percent, and each age group had a ratio exceeding 100 percent.

The overall ratio by amount for policy year 2 is 103 percent. In the previous study it was 94 percent. The largest increase occurred in the 35-44 age group, which has a 138 percent ratio as compared with a 93 percent ratio in the 1951-56 study.

It is to be noted that the overall mortality ratio for policy year 3 is 108 percent, similar to the mortality ratio of 105 percent experienced for policy year 3 in the previous study.

Policies versus Amounts

ADB mortality by number of policies is compared with the mortality by amount in Table 8, using broad age groups.

For each policy-year group, the ADB mortality ratios for all ages combined are decidedly higher by amount than by number of policies.

TABLE 8

ANALYSIS BY NUMBER OF POLICIES AND BY AMOUNT OF INSURANCE EXPERIENCE OF FOURTEEN COMPANIES, ALL ISSUE YEARS MORTALITY RATIOS EXPRESSED RELATIVE TO GRADUATED 1970-75 ADB RATES IN TABLE 3

Attained Ages	Policy	YEAR 1	Policy	YEAR 2	POLICY YEARS 3 ALL POLICY AND OVER YEARS			
Under 35 35-44	Number	Amount	Number	Amount	Number	Amount	Number	Amount
				Mortal	ity Ratios			
Under 35	90% 93 87 74	97% 113 123 134	87% 89 85 62	97% 138 108 61	96% 86 86 94	101% 98 97 102	94% 86 86 94	100% 102 98 101
All ages	90%	101%	87%	103%	92%	100%	91%	100%
			Am	ount of A	DB Claim	s Paid	<u> </u>	<u> </u>
Under 35	3,5, 1,6	32,024 38,476 39,728 57,557	3,9 1,4	92,189 42,017 45,290 94,280	35,1 29,0	31,704 29,150 64,690 98,768	32,1	55,917 09,643 49,708 50,605
All ages	\$26,4	67,785	\$20,5	73,776	\$153,9	24,312	\$200,9	65,873

The ratios by amount also are higher for each age group separately except for the 55 and over category in policy year 2. The 1951-56 study showed that the ratios by number of policies became slightly higher than the ratios by amount for ages 55 and over.

The data in Table 8 suggest antiselection by amount of insurance at all policy years and attained ages. This is confirmed by the claim experience by size group and policy year for both sexes combined as presented in Table 11C. However, Table 11A indicates no antiselection for males at ages below 35 for all amounts combined. Similarly, Table 11B indicates no antiselection for females at ages over 54 for all amounts combined.

Automatic versus Elective ADB Coverage

The companies were requested to subdivide their data into automatic or elective ADB coverage. Seven of the contributing companies had at least some policies that automatically included ADB coverage, but one company's experience had to be omitted because the automatic coverage could not be separated from the elective coverage. For the six remaining companies, Table 9 shows mortality ratios by amount by broad attainedage groups separately for automatic and elective ADB coverage. For these six companies, total claims reported under automatic ADB coverage were \$44 million, while total claims reported under elective ADB coverage were \$94 million.

The mortality ratios for automatic coverage are below 100 percent and decrease by attained-age group. The ratios decrease from 91 percent for

TABLE 9

AUTOMATIC VERSUS ELECTIVE ADB COVERAGE
EXPERIENCE OF SIX COMPANIES RELATIVE
TO GRADUATED 1970-75 ADB RATES IN TABLE 3

A	MORTALITY RATIOS BY AMOUNT OF CLAIMS PAID				
ATTAINED AGES	Automatic ADB Coverage	Elective ADB Coverage			
Under 35	91% 87 74	108% 110 106			
55 and over	72	108			
All ages	88%	108%			

ages under 35 to 72 percent for ages 55 and over. The overall ratio is 88 percent. In contrast, the overall ratio for the elective coverage of these six companies is 108 percent. This suggests antiselection on the part of those policyholders who elect accidental death benefit coverage.

Analysis by Size of Accidental Death Benefit, Sex, and Policy Year

Fourteen of the fifteen contributing companies were able to subdivide their experience by sex and policy year. Table 10 shows the relationship of the volume of data on female lives to the total volume contributed by these companies. The proportion of female exposures decreases with advancing attained age, and is greater by number of policies than by amount of insurance. For all ages combined, the female proportion is 27 percent by number of policies and 16 percent by amount of ADB coverage.

The experience of the fourteen companies is analyzed in Tables 11A, 11B, 11C, and 11D along with the experience of the ten companies that were able to identify ADB size groups. One of these ten companies only was able to subdivide experience into two size groups: less than \$100,000, and \$100,000 and over. A group for claims less than \$100,000 was set up so that this experience could be included.

Numbers of claims and mortality ratios by number and amount are shown for male data (Table 11A), female data (Table 11B), and combined data (Table 11C), each subdivided by policy year, attained-age groups, and size of the accidental death benefit. The expected deaths were based on the graduated 1970–75 claim rates of Table 3.

The overall mortality ratio for females is 41 percent of the correspond-

TABLE 10
FEMALE PERCENTAGES OF TOTAL EXPOSURES
ENTERING TABLE 11

Attained Ages	By Number of Policies	By Amount of ADB Coverage
Under 15.	42%	37%
15-24	34	24
25-34	27	15
35–44	24	13
45–54	24	13
55~64	23	13
65–74.	22	14
75 and over	18	10
All ages	27%	16%

TABLE 11A

MORTALITY RATIOS

ANALYSIS BY ADB SIZE GROUP, SEX, AND POLICY YEAR; MALES

EXPERIENCE OF TEN COMPANIES, ALL ISSUE YEARS

RATIOS EXPRESSED RELATIVE TO GRADUATED 1970-75 RATES IN TABLE 3

ATTAINED	Size of	Nt	(Policies)	MS	MORTALETY RATIO BY NUMBER OF CLAIMS			MORTALITY RATIO BY AMOUNT		
Attained Ages	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Polity Years	Policy Year 1	Policy Years 2 and Later	All Policy Years
Under 35	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	211 25 1,368 6	1,346 97 7,137 8	1,557 122 8,505 14	124′ 70 119	112% 92 118 †	114% 86 118 191	120% 67 114 †	105% 94 111	108% 87 111 206
	All sizes All sizes*	1,374 1,879	7,145 10,033	8,519 11,912	119% 119	118% 120	118% 120	117% 114	112% 115	113% 115
35-44	Less than \$25,000 \$25,000-99,999 Less than 100,000 \$100,000 and over	18 12 136 3	632 120 2,614 25	650 132 2,750 28	102% 117 136	90% 1111 98 269	90% 112 99 247	89% 129 147 †	83% 110 98 281	83% 112 100 255
	All sizes All sizes*	139 199	2,639 3,987	2,778 4,186	136° 6 124	98% 190	100% 101	145% 128	106% 109	108% 110

^{*} Experience of fourteen companies; includes data that did not contain policy-size information † Fewer than 10 claims.

TABLE 11A-Continued

	Size of	Nt	Number of Claims (Policies)			Mortality Ratio by Number of Claims			MORTALITY RATIO BY AMOUNT		
ATTAINED AGES	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	
45–54	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	13 4 51 3	721 96 2,232 13	734 100 2,283 16	169% † 115 †	105% 110 99 180	106% 109 99 200	161% † 137	107% 108 103 173	108% 108 104 190	
	All sizes	54	2,245	2,299	120%	99%	99%	171%	106%	108%	
	All sizes*	90	3,546	3,636	126	99	99	142	104	105	
55 and over	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	1 0 3 1	1,282 52 2,049 6	1,283 52 2,052 7	† † †	110% 125 112 †	110% 123 112 †	† † †	105% 120 111 †	105% 117 111 †	
	All sizes	4	2,055	2,059	†	113%	112%	†	114%	114%	
	All sizes*	13	3,476	3,489	77%	106	106	166%	110	110	
All ages	Less than \$25,000	243	3,981	4,224	123%	106%	107%	118%	101%	102%	
	\$25,000-\$99,999	41	365	406	81	106	103	84	106	103	
	Less than \$100,000	1,558	14,032	15,590	119	110	111	118	106	108	
	\$100,000 and over	13	52	65	236	217	221	217	225	223	
	All sizes	1,571	14,084	15,655	120%	110%	111%	122%	110%	111%	
	All sizes*	2,181	21,042	23,223	119	110	110	117	111	112	

TABLE 11B

MORTALITY RATIOS

ANALYSIS BY ADB SIZE GROUP, SEX, AND POLICY YEAR; FEMALES EXPERIENCE OF TEN COMPANIES, ALL ISSUE YEARS

RATIOS EXPRESSED RELATIVE TO GRADUATED 1970-75 RATES IN TABLE 3

	Size of	Number of Claims (Policies)			Mortality Ratio by Number of Claims			MORTALITY RATIO BY AMOUNT		
ATTAINED	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years
Under 35	Less than \$25,000	26	167	193	38%	39%	39%	50%	47%	47%
	\$25,000-\$99,999	1	4	5	†	†	†	†	†	†
	Less than \$100,000	214	856	1,070	36	36	36	37	37	37
	\$100,000 and over	2	0	2	†	†	†	†	†	†
	All sizes	216	856	1,072	36%	36%	36%	43%	37%	38%
	All sizes*	312	1,297	1,609	36	36	36	43	36	38
35-44	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	5 1 38 0	68 2 252 0	73 3 290 0	51°00	41% † 39 †	42% † 40 †	† 60% †	47% † 40 †	49% † 42 †
	All sizes	38	252	290	51%	39%	40%	58%	39%	41%
	All sizes*	52	462	514	48	39	39	52	41	42

^{*} Experience of fourteen companies; includes data that did not contain policy-size information.

[†] Fewer than 10 claims.

TABLE 11B-Continued

	Size of	N	UMBER OF CLAI (Policies)	M S		IORTALITY RAT Number of Cl		MORTALITY RATIO BY AMOUNT		
Attained Ages	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Yers
45-54	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	,000-\$99,999 1 0 1 s than \$100,000 11 274 285	1 285	† 29%	46% † 45 †	47% † 44 †	† 80% †	62% † 47 †	62% † 49 †	
	All sizes	11	274	285	29%	45%	44%	75%	46%	48%
	All sizes*	19	531	550	36	47	46	61	50	51
55 and over.	Less than \$25,000	0	197	197	†	60%	60%	†	64%	64%
	\$25,000-\$99,999	0	1	1	†	†	†	†	†	†
	Less than \$100,000	4	274	278	†	54	54	†	45	44
	\$100,000 and over	0	0	0	†	†	†	†	†	†
	All sizes All sizes*	4 8	274 1,222	278 1,230	† †	54% 71	54% 71	† †	44% 67	43% 67
All ages	Less than \$25,000	33	517	550	41%	47%	47%	53%	52%	52%
	\$25,000-\$99,999	3	7	10	†	†	39	†	†	30
	Less than \$100,000	267	1,656	1,923	37	40	40	41	39	40
	\$100,000 and over	2	0	2	†	†	†	†	†	†
	All sizes	269	1,656	1,925	37%	40%	40%	46%	39%	40%
	All sizes*	391	3,512	3,903	38	46	45	45	44	44

TABLE 11C

MORTALITY RATIOS

ANALYSIS BY ADB SIZE GROUP, SEX, AND POLICY YEAR; BOTH SEXES

EXPERIENCE OF TEN COMPANIES, ALL ISSUE YEARS

RATIOS EXPRESSED RELATIVE TO GRADUATED 1970-75 RATES IN TABLE 3

	Size of	Number of Claims (Policies)		MORTALITY RATIO BY NUMBER OF CLAIMS			MORTALITY RATIO BY AMOUNT			
ATTAINED AGES Under 35	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years
Under 35	Less than \$25,000	237	1,513	1,750	99°.,	93%	94%	106%	96%	97%
	\$25,000-\$99,999	26	101	127	68	90	84	64	91	84
	Less than \$100,000	1,582	7,993	9,575	90	95	94	96	97	96
	\$100,000 and over	8	8	16	†	†	205	†	†	219
	All sizes	1,590	8,001	9,591	91°	95%	94%	100%	97%	98%
	All sizes*	2,191	11,330	13,521	90	95	94	97	100	100
35–44	Less than \$25,000	23	700	723	90%	81%	81%	87%	79%	80%
	\$25,000-\$99,999	13	122	135	115	108	108	124	106	108
	Less than \$100,000	174	2,866	3,040	99	86	87	126	91	93
	\$100,000 and over	3	25	28	†	256	235	†	267	242
	All sizes	177	2,891	3,068	100%	87%	88%	126%	99%	100%
	All sizes*	251	4,449	4,700	93	86	86	113	101	102

^{*} Experience of fourteen companies; includes data did not contain policy-size information.

[†] Fewer than 10 claims.

TABLE 11C -Continued

.	Size of	Number of Claims (Policies)		MS	MORTALITY RATIO BY NUMBER OF CLAIMS			Mortality Ratio by Amount		
ATTAINED AGES	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years
45-54	Less than \$25,000 \$25,000-\$99,999	15 5	806 96	821 101	131%	93%	93% 103	135%	102% 101	103% 102
	Less than \$100,000	62	2,506	2,568	75	87	87	122	96	97
	\$100,000 and over	3	13	16	Ť	169	186	Ť	162	177
	All sizes	65	2,519	2,584	78%	88%	87 <i>6</i>	147%	99%	101%
	All sizes*	109	4,077	4,186	87	86	86	123	97	98
55 and over	Less than \$25,000	1	1,479	1,480	†	99%	99%	†	100%	100%
	\$25,000-\$99,999	0	53	53	†	117	115	ţ	111	109
	Less than \$100,000 \$100,000 and over	7 1	2,323	$\frac{2,330}{7}$	†	100	99 †	†	103	102
	[2 220	2 227		1000	10041		10501	10501
	All sizes All sizes*	8 21	2,329 4,698	2,337 4,719	74%	100% 94	$\frac{100\%}{94}$	134%	105% 101	$\frac{105\%}{101}$
All ages	Less than \$25,000	276	4,498	4,774	99%	93%	93%	104%	94%	95%
	\$25,000-\$99,999	44	372	416	80	102	99	82	101	99
	Less than \$100,000	1,825	15,688	17,513	90	93	92	99	96	96
	\$100,000 and over	15 	52	67	253	203	213	234	211	215
	All sizes	1,840	15,740	17,580	91%	93%	93%	105%	99%	100% 100
		1,840 2,572	15,740 24,554	17,580 27,126	91% 90	93%	93% 91	105% 101	99% 100	_

TABLE 11D

MORTALITY RATIOS

ANALYSIS BY ADB SIZE GROUP, SEX, AND POLICY YEAR RATIOS OF FEMALE TO MALE MORTALITY RATIOS EXPERIENCE OF TEN COMPANIES, ALL ISSUE YEARS

Attained	Size of	1	MORTALITY RATE BY NUMBER	0	MORTALITY RATIO BY AMOUNT			
AGES	ACCIDENTAL DEATH BENEFIT	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	
Under 35	Less than \$25,000	31%	35%	34%	42%	44%	44%	
	\$25,000-\$99,999	+	†	†	†	†	†	
	Less than \$100,000	30	31	31	32	33	33	
	\$100,000 and over	+	†	†	†	†	†	
	All sizes	30%	31%	31%	37%	33%	34%	
	All sizes*	30	30	30	38	32	33	
35-44	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	37% †	46% † 40 †	47% † 41 †	† 41% †	56% † 41 †	59% † 42 †	
	All sizes	37%	40%	40%	40%	37%	38%	
	All sizes*	38	39	39	40	38	39	

^{*} Experience of fourteen companies; includes data that did not contain policy-size information.

[†] Either the male or female experience had fewer than 10 claims.

TABLE 11D-Continued

Attained	Size of]	MORTALITY RATIO	0	MORTALITY RATIO BY AMOUNT			
Ages	Accidental Death Benefit	Policy Year 1	Policy Years 2 and Later	All Policy Years	Policy Year 1	Policy Years 2 and Later	All Policy Years	
45-54	Less than \$25,000 \$25,000—\$99,999 Less than \$100,000 \$100,000 and over	† † 25% †	44% † 46 †	44% † 45 †	† † 58%	58% † 46 †	57% † 47 †	
	All sizes All sizes*	24% 28	46% 47	45% 47	44% 43	43% 48	44% 48	
55 and over	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	† † †	54% † 48 †	54% † 48 †	† † † †	61% † 40 †	61% † 40 †	
	All sizes All sizes*	†	48% 67	48% 67	†	38% 61	38% 61	
All ages	Less than \$25,000 \$25,000-\$99,999 Less than \$100,000 \$100,000 and over	33% † 31 †	44% † 37 †	43% 38 36 †	45% † 35 †	52% † 37 †	51% 30 37 †	
	All sizes All sizes*	31% 32	37% 42	36% 41	38% 38	35% 39	36% 39	

ing ratio for males by number of policies and 39 percent by amount, as shown at the bottom of Table 11D. These percentages vary considerably by attained age, however, increasing from 30 percent by number of policies and 33 percent by amount at ages under 35 to 67 percent and 61 percent, respectively, at ages 55 and over. The overall claim ratios based on the graduated male-female table (Table 3) are 110 percent by number of policies and 112 percent by amount for males (Table 11A), and 45 percent by number of policies and 44 percent by amount for females (Table 11B).

The mortality ratios by ADB size for males (Table 11A) show a general upward trend as the ADB size increases. Based on the graduated male-female table, by amount of claims for all ages and policy years combined, the mortality ratios are 102 percent for the under \$25,000 group, 103 percent for the \$25,000-\$99,999 group, and 223 percent for the \$100,000 and over group. The ratios shown for policies in the \$100,000 and over group, by both number and amount, are about double the ratios for the less than \$100,000 group. There is not enough experience over \$25,000 for females (Table 11B) to permit an analysis. For males and females combined (Table 11C), the various ADB mortality ratios shown for all ages combined in the \$100,000 and over group, by both number and amount, are more than double the corresponding ratios for the less than \$100,000 group.

To provide a standard of comparison for those who desire to analyze their experience on male and female lives separately, tables of graduated claim rates for male and female lives have been prepared and are presented in Tables 12 and 13. The graduation process for each table is described in section 2 of Appendix I.

Company Variations

Table 14 lists the companies in ascending order of ratios of actual ADB deaths by amount to expected ADB deaths based on the graduated 1970–75 paid claim rates of Table 3. Ratios based on numbers of claims (policies) paid are also given, along with the probable deviation of such ratios, which was computed by the formula $\pm \frac{2}{3} MR/\sqrt{\theta'}$ where MR is the mortality ratio and θ' is the number of policies terminated by death. Assuming a normal distribution of mortality ratios, the chances theoretically are even that an observed mortality ratio will fall within the range covered by the plus and minus probable deviation from the true value.

It is evident from Table 14 that there is considerable variation among the individual contributors in the level of claim rates experienced. The amount ratios, ranging from 73 to 144 percent, have a greater spread than the policy ratios, presumably because of the distortions associated with small and varying proportions of large-amount exposures. The policy ratios range from 80 to 130 percent. The corresponding spreads in the 1951–56 study, with mortality ratios based on the graduated 1951–56 experience table, were greater, from 50 to 169 percent by amount and from 75 to 131 percent by number of policies.

TABLE 12

GRADUATED 1970-75 MALE ADB CLAIM RATES
(Aggregate Experience Based on Amount of Claims Paid)

Attained	Claim Rate	Attained	Claim Rate	Attained	Claim Rate
Age	per 1,000	Age	per 1,000	Age	per 1,000
1	.506	36.	.379	71	.872
2	.443	37.	.376		.977
3	.371	38.	.378		1.078
4	.298	39.	.388		1.169
5	.230	40.	.406		1.251
6 7 8 9 10	.174 .137 .118 .114	41 42 43 44 45	.426 .445 .455 .455 .446	76 77 78 79 80	1.457 1.663 1.869 2.075 2.280
11	.153 .202 .284 .404 .553	46. 47. 48. 49. 50.	.435 .428 .425 .423 .423	81	2.486 2.692 2.898 3.104 3.711
16	.709	51	.426	86.	4.209
	.839	52	.429	87.	4.544
	.919	53	.433	88.	4.787
	.940	54	.440	89.	5.002
	.908	55.	.449	90.	5.176
21	.834	56.	.455	91	5.276
	.740	57.	.457	92	5.357
	.645	58.	.459	93	5.476
	.563	59.	.466	94	5.687
	.500	60.	.480	95	6.046
26	.457 .430 .412 .400 .392	61	.499 .522 .545 .564 .582	96. 97. 98. 99. 100.	6.608 7.429 8.564 10.069 12.000
31	.388 .387 .388 .388 .385	66. 67. 68. 69. 70.	.605 .628 .661 .711 .781		

TABLE 13

GRADUATED 1970-75 FEMALE ADB CLAIM RATES (Aggregate Experience Based on Amount of Claims Paid)

Attained Age	Claim Rate per 1,000	Attained Age	Claim Rate per 1,000	Attained Age	Claim Rate per 1,000
10		30		50	. 198
11	.065 .076	31	. 184 . 191	51	. 197 . 197
		33		53	. 194
l 4 [. 128	34	. 186	54	. 186
15	. 167	35	. 178	55	. 172
6	. 204 . 234	36		56	. 158 . 155
7 8	. 254	38	.161	57	.155
9	. 257	39	160	59	. 193
20	. 247	40	. 161	60	. 220
21		41	.165	61	. 240
22		42.	, 172 , 183	62 63.	. 246 . 237
24		44	197	64.	. 220
25	. 142	45	208	65	201
26		46	.212	(İ	
27		47	209		
28 29	. 140	48	. 203 . 200		

TABLE 14

ANALYSIS BY COMPANY
ALL YEARS OF ISSUE AND POLICY YEARS COMBINED
RATIOS EXPRESSED RELATIVE TO GRADUATED 1970-75
RATES IN TABLE 3

	Number of	MORTALITY RATIO				
Company*	ADB CLAIMS PAID	By Number of ADB Claims Paid	By Amount Paid			
A	184	81 ± 4%	73%			
В	162	93±5	87			
C	724	87 ± 2	90			
D	512	91±3	91			
Е	3,721	88±1	94			
F	458	100 ± 3	98			
G	12,344	92±1	99			
H	3,275	80±1	100			
[426	95±3	103			
J <i>.</i>	1,667	92±2	105			
К	379	95 ± 3	106			
[1,898	99±2	106			
M	299	91±4	112			
N <i></i>	652	96±3	121			
0	883	130±3	144			

^{*} Companies D, F, G, H, J, L, and N had at least some policies that included ADB coverage automatically. Companies A, B, C, D, E, G, H, I, J, K, M, and O subdivided their ADB paid claims by cause of death.

It is evident that the graduated 1970-75 claim rates of Table 3 are not adequate to cover the actual claims of about half of the companies that contributed to the present investigation. The fact that the more extreme departures from 100 percent generally are associated with larger probable deviations indicates that some of the variance is due to limited volumes of data.

COMPARISON WITH POPULATION DATA

Table 15 compares insurance company data separately for males and females for the experience years between 1970 and 1975 anniversaries with the United States white population data for calendar years 1970–75. The experience by number of policies of the twelve companies that subdivided their experience by cause of death was used in order to exclude suicides, homicides, and injuries resulting from operations of war, which were excluded from population data.

TABLE 15

COMPARISON OF INSURANCE COMPANY ADB EXPERIENCE
WITH POPULATION ACCIDENTAL DEATH EXPERIENCE
INSURANCE COMPANY RATES BASED ON AGGREGATE DATA
BY POLICIES OF TWELVE COMPANIES

		MALES			FEMALES	_
ATTAINED AGES	Rates p	оет 1,000	Ratio,	Rates p	Ratio,	
AGES	Insurance	U.S. White	Insurance to	Insurance	U.S. White	Insurance to
	Data,	Population,	Population	Data,	Population,	Population
	1970-75*	1970-75†	Data	1970–75*	1970-75†	Data
10–14	.194	.271	72%	.075	.112	67%
15–19	.829	1.000	83	.225	.293	77
20–24	.704	1.111	63	.176	.241	73
25–29	.415	.800	52	.107	.183	58
30–34	.352	.661	53	.123	.170	72
35-39	.322	.624	52	.109	.174	63
40-44	.353	.614	57	.140	.200	70
45-49	.349	.649	54	.168	.221	76
50-54	.350	.669	52	.168	.244	69
55-59	.374	.748	50	.219	.281	78
60-64	.471 .581 .776	.842 .921 1.186	56 63 65	. 265	.340	78

^{*} Suicides, homicides, and injuries resulting from operations of war are not included.

[†] These rates reflect all accidental deaths coded E800 to E949, Eighth Revision (1970), International List. Suicides, homicides, and injuries resulting from operations of war are not included. The rates were obtained from information provided by the Actuarial Statistical Bureau of the Metropolitan Life Insurance Company.

For male lives the insurance claim rates are slightly over 50 percent of the population accidental death rates over the important attained-age range from 25 to 64. Presumably, the explanation lies mostly in the classes of lives included in the respective sets of data. The population figures would, for example, include proportionately more individuals subject to industrial accidental hazards than do the standard ordinary insurance data.

For female lives, the insurance claim rates are much closer to the population experience. This perhaps should not be surprising, since industrial accidents do not play the same role here.

EXCLUSIONS FROM COVERAGE

The companies contributing to the study were asked to furnish information about the types of exclusions appearing in their ADB clauses in the years of issue 1960, 1965, 1970, and 1974 that actually were being enforced in their claim administration during the observation period of the study. Table 16 summarizes the replies received from the fifteen contributing companies.

TABLE 16

EXCLUSIONS FROM ADB COVERAGE

NUMBER OF CONTRIBUTING COMPANIES APPLYING SPECIFIED EXCLUSION
DURING 1970-75 OBSERVATION PERIOD

TOTAL NUMBER OF COMPANIES: FIFTEEN

_		Issue Year	of Policy	
EXCLUSION	1960	1965	1970	1974
Self-destruction	15	15	15	15
Illness or disease	15	15	15	15
Committing assault or felony	8	7	7	7
Inhaling gas or fumes	9	8	8	8
Air travel except as fare-paying passenger.	12	12	12	12
Space travel	2	3	4	4
Insurrection	4	4	4	4
Riot	2	2	3	3
Submarine activities	1	0	0	0
Medical treatment or surgery	8	9	9	8
Drug overdose.	7	8	9	9
Drug sensitivity	5	6	6	5
Poison	8	8	9	8
Homicide	1	1	1	1
Gunshot wound	1	0	0	0
Caused by war.	15	15	15	15
Caused by war while in military service	11	11	11	11
Occurring in time of war while in military ser-				
vice	7	7	7	6

Causes of accidental death that have been excluded from coverage to an increasing extent over these fourteen years of issue include space travel and drug overdose. On 1960 issues, two companies excluded death due to space travel and seven companies excluded drug overdose; on 1974 issues the companies with such exclusions were four and nine, respectively. For each of the other causes included in the illustrative list in Table 16, there has been no significant change in the degree of exclusion by the companies over the fourteen-year period.

However, a comparison with the 1951-56 study reveals some significant changes since the 1955 year of issue. In 1955, out of sixteen contributing companies, fourteen companies excluded death due to committing assault or felony, thirteen excluded death due to inhaling gas or fumes, ten excluded death due to insurrection, eight excluded death due to riot, and six excluded death due to submarine activities. Of 1960 issues, the corresponding numbers with such exclusions were 8, 9, 4, 2, and 1, respectively, out of fifteen companies.

Of the sixteen companies that contributed to the previous study, eleven also contributed to the current study.

TRIPLE INDEMNITY BENEFITS

For this study, a triple indemnity benefit is defined as one under which twice the usual accidental death benefit is paid when death is the result of riding as a passenger on a public conveyance. (Experience under other types of "triple indemnity" benefits issued by some of the companies was not included in this portion of the study.)

Of the fifteen contributing companies, four had such a "public conveyance" triple indemnity benefit. The total experience of these companies amounted to only 61 claims for \$865,129 on exposures of \$198 billion. Because of the small number of claims, no detailed study was made.

Another company also had a triple indemnity benefit that provided an additional payment equal to the face amount of the policy if accidental death was sustained by the insured (a) while driving or riding in a private automobile not in use for commercial or occupational purposes by the insured, or (b) as a result of being struck by a motor vehicle while not driving or riding in a motor vehicle, or (c) while riding as a passenger in or upon a public conveyance provided by a common carrier for passenger service.

Because this definition is less restrictive, the claim experience, which amounted to 3,455 claims for \$16,729,039 on exposures of \$86 billion, could not be combined with the experience of the four other companies.

Since these data were submitted by only one company, it was felt that a detailed study would not be useful. Information on motor vehicle deaths (a substantial portion of this experience) has been analyzed for all contributing companies in Tables 5 and 6.

The ten other contributing companies did not offer a triple indemnity benefit of the types defined above.

APPENDIX I

DESCRIPTION OF GRADUATION PROCESS

1, 1970-75 AGGREGATE ADB CLAIM RATES

(MALES AND FEMALES COMBINED)

The table of graduated 1970-75 ADB claim rates (Table 3) was produced to facilitate the analysis of the various subdivisions of the study. The 1951-56 table was not suitable for this purpose because the changes in the accidental death claim rates since the period covered by that table vary so markedly by attained age.

The new table is based on the total data by amount in all sections of the study combined except where the crude rates appeared not to be significant, that is, aggregate data for both sexes and all policy years were used. These crude data are shown in Table A, together with the final graduated rates as extended to include all attained ages from 1 through 100.

The first phase of the graduation process was the development of graduated values for each of the attained ages from 5 through 91 by application of the Whittaker-Henderson third-difference A formula with K=8. This value of K was selected so that the graduated rates would follow closely the crude rates and reflect the hump in the rates that occurs between attained ages 16 and 24, inclusive. The formula was not applied at ages below 5 or above 91, since each of these ages involved less than 20 claims.

For ages 1–4, a graphic technique was developed with reference to percentages of population accidental death rates for white lives in the United States for the calendar years 1970–73. The population accidental death rates that were used were determined by combining the rates for male and female lives on a basis that reflected the composition of insurance data by sex.

The graduated values were extended to age 100 by fitting a third-degree curve to the graduated rates at ages 89, 90, and 91 and a rate of 12 per thousand at age 100. The latter rate was arrived at by inspection of United States population accidental death rates for the calendar years 1970–73.

Table A compares the actual and the graduated experience. Table B tests the graduation procedure by comparing the actual and tabular claims in five-year age groups and in broader age groups.

2. 1970-75 MALE AND FEMALE ADB CLAIM RATES

For companies desiring to analyze their experience on male and female lives separately, Table 12 showing male ADB rates and Table 13 showing female ADB rates were prepared. These two sets of rates are consistent with the 1970–75 aggregate ADB claim rates in Table 3.

Since all fifteen contributing companies were able to subdivide their contributions by sex, except at the high attained ages, the graduation was performed directly on the male and female crude rates.

TABLE A
SUMMARY OF TOTAL CONTRIBUTIONS
USED IN DEVELOPMENT OF GRADUATED
1970-75 ADB CLAIM RATES

TTAINED	Num- ber of	AMOUNT		RATES 1,000	ATTAINED	Num- BER OF	AMOUNT	CLAIM PER	RATES 1,000
AGE	CLAIMS PAID	OF CLAIMS PAID	Crude	Grad- uated	AGE	CLAIMS PAID	OF CLAIMS PAID	Crude	Grad- uated
	5	\$ 33,349	. 151	.480	51	384	\$3,179,503	.410	. 39
	8	55,100	. 241	. 383	52	407	3,203,750	. 446	.39
	12	80,000	. 339	.301	53	381	2,290,412	. 346	. 40
	6 30	24,500	.107 .191	.234 181	55	350 378	2,248,927	.373	.40
	29	152,750 110,250	.117	141	56	304	2,516,009 2,300,067	453	4
	31	139,970	.131	113	57	304	1,876,971	404	4
	32	125,499	.078	097	58	310	1.666,474	392	4
1	40	150,167	.094	. 093	59	326	1,559,609	. 409	.4
0	42	195,000	.120	100	60 .	309	1,620,149	. 489	. 4
1	46	275,781	.168	120	01	276	1,261,544	.428	4
2	57 53	288,700	.171	.156	1 62	280	1,203,000	.460	4
i	96	277.398 514,630	153 258	.313	63 . 64	259	1,429,866	.614 476	5
5	181	926,661	397	432	65	245 128	974,676 464,063	400	.5
6	298	1,720,705	610	557	66	139	649,062	657	5
7	424	2.534.823	693	663	67	1.54	521,670	598	5
8	621	3,992,934	.771	. 732	68	114	360,807	472	. 5
9	741	4,952,054	.737	. 757	69	108	434,087	679	. 6
0	882	6,281,816	.759	739	70	61	177,738	. 592	. 6
1	950	6,944,564	.699	. 688	71	54	114,963	.657	7
2	896	6,717,551	.579	619	72	57	169,470	1.016	. 7
3	885 957	7,052,845	.532	.548	73	64 47	147,703 103,013	. 911	.8
5	771	6,292,791	.406	.436	75	49	167,000	1.107	1.0
6	751	6,410,117	406	.402	76	76	214,347	1.492	1.2
7	705	6,397,680	405	381	77	55	141,500	1.046	1.3
8	632	5,525,944	.358	369	78	67	211,352	1.695	1.4
9	691	5,741,817	.379	. 362	79	52	142,145	1.252	1.6
0	607	5,324,512	.354	. 360	80	78	236,474	2.320	1.7
1	586	5,191,550	.352	. 360	81	72	218,649	2.460	1.9
2	582	5,111,913	.365	.361	82	47	136,879	1.764	2.1
3 4	536 546	4,520,004	339	.363	84	37 56	80,079	1 221	2.5
5	492	4,969,105	393	.359	85	57	167,924 197,356	4.472	3.1
6	479	4,260,794	345	354	86	61	192,438	5.415	4.2
7	464	3.975.541	331	348	87	41	113,200	4.074	4.5
8	456	4,000,008	344	350	88	36	82,972	3.827	4.7
9	503	4,142,004	.366	. 359	89	33	79,500	4.955	5.0
0	431	3,882,096	.351	. 374	90	21	71,862	5.908	5.1
1	472	4,412,191	406	. 39.3	91	21	43,886	5.002	5 2
2	447	4,320,207	.400	410	92	8	33,194	5.674	5.3
3	495	4,783,598	.447	420	93	11	20,576	4.909	5.4
5	527 462	4,623,399	438	421	94	12	10,758	3.740	5.6
6		3.871.189	.387	406	96	0	32,373	.014	6.6
17	462	3,339,059	.346	399	97	0	0		7.4
8	459	4,198,139	456	396	98	ŏ	ŏ		8.5
9	470	3,471,800	395	394	99	ŏ	ŏ		10.0
50	427	2,994,550	361	394	100	ő	ĺ	1	12.0

TABLE B
TEST OF FIT OF GRADUATION
1970-75 AGGREGATE ADB CLAIM RATES

Attained Ages	Actual Claims	Tabular Claims	Actual Minus Tabular Claims	Ratio of Actual to Tabular Claims	
1-4	\$ 192,949	\$ 318,465	-\$125,516	60.6%	
5-9	678,636	703,878	- 25,242	96.4	
10-14	1,551,509	1,643,244	- 91,735	94.4	
15-19	14,127,177	13,884,570	242,607	101.7	
20-24	34,359,059	34,509,874	- 150,815	99.6	
25-29	30,368,349	30,295,545	72,804	100.2	
30-34	25,053,172	25,328,568	- 275,396	98.9	
35-39	21,347,452	21,211,103	136,349	100.6	
40-44	22,021,491	21,770,111	251,380	101.2	
45-49	19,148,576	19,294,098	- 145,522	99.2	
50-54	13,917,142	14,310,633	- 393,491	97.3	
55-59	9,919,130	9,753,362	165,768	101.7	
60-64	6,489,235	6,323,528	165,707	102.6	
65-69	2,429,689	2,459,680	- 29,991	98.8	
70-74	712,887	749,402	- 36,515	95.1	
75-79	876,344	891,613	- 15,269	98.3	
80-84	840,005	851,531	- 11,526	98.6	
85-89	665,466	623,681	41,785	106.7	
90-94	180,276	179,911	365	100.2	
95-99	32,373	12,315	20,058	262.9	
All ages	\$204,910,917	\$205,115,112	-\$204,195	99.9%	
Under 25.	\$ 50,909,330	\$ 51,060,031	- 150,701	99.7%	
25-34.	55,421,521	55,624,113	- 202,592	99.6	
35-44.	43,368,943	42,981,214	387,729	100.9	
45-54.	33,065,718	33,604,731	- 539,013	98.4	
55-64.	16,408,365	16,076,890	331,475	102.1	
65 and over.	5,737,040	5,768,133	- 31,093	99.5	

Male Experience

Graduated values were developed for each attained age from 5 through 75 by application of the Whittaker-Henderson third-difference A formula with K=8. The formula was not applied at attained ages below 5 or above 75, since each of these ages involved less than 20 claims.

For attained ages 1-4, a graphic technique was used with reference to percentages of United States population accidental death rates for white male lives for the calendar years 1970-73.

For attained ages 76-84, the graduated values were extended linearly to a value of 100 percent of the combined male-female graduated rate for attained age 84 as shown in Table 3. A 100 percent ratio also was used for ages 85-100, where the exposure was almost entirely on male lives.

Female Experience

Graduated values were developed for each attained age from 10 through 65 by application of the Whittaker-Henderson third-difference A formula with K=8. The formula was not applied at attained ages below 10 or above 65, since each of these ages involved less than 20 claims.

3. GRADUATED RATES WITH ADJUSTMENT FOR MOTOR VEHICLE DEATHS

Because of the marked decrease in the relative importance of motor vehicle accidents beginning in the 1973-74 policy year, it was decided that the total ADB claim rates for males and females combined should be presented with the motor vehicle claim rate component first adjusted to reflect the 1970-73 level and then adjusted to reflect the 1973-75 level.

In order to give equal weight to each policy year, crude motor vehicle rates per \$1,000 for individual attained ages were calculated for each of the five policy years included in the study. Next, crude motor vehicle rates were calculated for 1970–73, 1973–75, and 1970–75 by averaging the rates of the appropriate individual years. Then the 1970–75 motor vehicle rates were subtracted from the total crude rates shown in Table A and the 1970–73 motor vehicle rates were added to create the crude rates that were the basis for Table C. The crude rates underlying Table D were created in a corresponding fashion. The graduation method used was again the Whittaker-Henderson third-difference A formula with K=8. Graduated rates below attained age 5 and over attained age 70 are not shown because there were very few motor vehicle claims at those ages.

The graduated rates in Table D generally are slightly lower than those in Table C except at attained ages 13-17 and 49-51.

TABLE C

GRADUATED 1970-75 ADB CLAIM RATES WITH MOTOR VEHICLE DEATHS ASSUMED TO BE AT 1970-73 LEVEL

MALES AND FEMALES COMBINED

EXPERIENCE OF TWELVE COMPANIES BASED ON AMOUNTS OF CLAIMS PAID

Attained Age	Claim Rate per 1,000	Attained Age	Claim Rate per 1,000	Attained Age	Claim Rate per 1,000
5	.213 .158 .123 .105 .102	30 31 32 33	.368 .369 .373 .376 .377	55	.441 .448 .450 .454 .466
10	.110 .127 .158 .213 .299	35 36 37 38 39	.372 .363 .354 .353 .362	60	. 484 . 502 . 520 . 532 . 539
15	. 412 . 537 . 651 . 735 . 776	40	.381 .405 .429 .445 .449	65. 66	. 546 . 559 . 573 . 591 . 616
20	.771 .727 .658 .581	45	. 442 . 427 . 411 . 397 . 387	70	. 648
25	. 456 . 418 . 395 . 381 . 372	50 51 52 53 54	.384 .389 .400 .414 .429		

TABLE D

GRADUATED 1970-75 ADB CLAIM RATES WITH MOTOR VEHICLE DEATHS ASSUMED TO BE AT 1973-75 LEVEL

MALES AND FEMALES COMBINED

EXPERIENCE OF TWELVE COMPANIES BASED ON AMOUNTS OF CLAIMS PAID

Attained Age	Claim Rate per 1,000	Attained Age	Claim Rate per 1,000	Attained Age	Claim Rate per 1,000
5	. 133	30	.343	55.	. 369
6	. 114	31	.343	56	. 369
7	. 098	32.	. 342	57	.370
8,	086	33	341	58	.372
9	.080	34	. 340	59	.377
10	.086		. 339	1 6Ú.	388
11	. 109	36	. 340	61	. 404
12	.154	37	. 342	62	. 426
13	. 229	38	. 348	63	.450
14	. 335	39	.356	64	.474
15	. 462	40	.366	65	. 500
16	. 585	41	.375	66	. 529
17		42	. 381	67	. 552
18	.727	43	.381	68	. 568
19	. 727	41	.376	69	. 574
20	. 690	45	.372	70	. 564
21	. 630	46	.373	[]	
22		47	. 380	{}	
23	. 500	48	. 393	1	
24	.447	49	.405		
25	. 407	50	.410		
26	.378	51	.395	il	
27	.359	52	381	li l	
28	. 348	53	372	[]	
29	.344	54	. 369]] .	

APPENDIX II

SPECIFICATIONS FOR THE STUDY OF EXPERIENCE UNDER ADB PROVISIONS IN ORDINARY INSURANCE POLICIES BETWEEN 1970 AND 1975 POLICY ANNIVERSARIES

GENERAL

The study is designed to examine the mortality experience between 1970 and 1975 policy anniversaries under accidental death benefit provisions issued by life insurance companies as a part of Ordinary life insurance policies in the United States. All available years of issue should be included.

SCOPE

Experience will be studied by age, sex, policy duration, policy size, and cause of death.

Age will be attained age at the beginning of the policy year exposed. Please indicate whether ages are calculated near birthday or last birthday. If your company has used both bases, data should be subdivided so that age adjustments can be made.

Policy years 1, 2, and 3 will be studied individually, but policy years 4 and later will be combined.

Experience will also be studied in subdivisions according to sex and to three classifications according to basic ADB amount: under \$25,000, \$25,000-\$99,999, and \$100,000 and over.

Exposures should be summarized in the format of Attachment 3. Claims should be submitted in detailed form (one record per claim) in the format of Attachment 4.

INCLUDED AND EXCLUDED POLICIES

Rules for inclusion and exclusion are the same as those which apply to the Annual Study of Mortality under Standard Ordinary Insurance Issues.

Exclusions

- 1. Policies not subject to the company's usual underwriting standards.
 - a) Group conversions.
 - b) Term conversions and renewals (see item 2 under "Inclusions").
 - c) Family policy conversions on dependents.
 - d) Benefits issued as a result of exercise of an option under a guaranteed insurability rider.
 - e) Benefits issued on a "guaranteed issue" basis.
 - f) Benefits subject to simplified underwriting or issued up to a mortality limit higher than is customarily used by the company for standard ordinary insurance.
- 2. Policies with substandard benefits (even if base policy is standard).
- 3. Benefits in force under extended term or reduced paid-up provisions.

- 4. Experience on wives and children insured under family policies.
- 5. Joint life policies.
- 6. Reinsurance assumed.
- 7. Benefits issued in Canada (if possible).
- 8. Exposures when benefit is not applicable, that is, before age 5, after age 70, excess of base plan face amount over ADB limit.

Inclusions

- Reinsurance ceded.
- 2. Term conversions and renewals if they can be treated as issued on issue date of original policy. Otherwise, these policies should be excluded.
- Benefits added after issue. They should be treated as issued on add-on date if possible.
- 4. Policies where ADB is automatically included.

TREATMENT OF CLAIMS

If a claim incurred from any of the causes of death being studied was not settled for the full amount exposed, include it as one claim for the actual amount paid. This includes suicides during the exclusion period, compromised claims, and claims limited by exclusions or restrictions in the policy. For decreasing benefits, such as those attached to decreasing term, the amount shown for a claim paid in full should be the same as the amount shown in the exposures.

Triple indemnity amounts will be studied separately. Triple indemnity claims are those on which twice the usual ADB amount is paid because death was the result of riding as a passenger on a public conveyance. The amount coded in the "deaths" field of the claim input and the amount coded in the "triple indemnity claim amount" field for a triple indemnity claim paid in full should each equal the amount coded in the "exposed" field, namely, the basic amount exposed when a public conveyance is not involved.

CAUSES OF DEATH

A list of causes of death to be studied is given in Attachment 2.

QUESTIONNAIRE

The questionnaire (Attachment 1) is designed to elicit information about exclusions and other practices.

TRANSMISSION OF DATA

Formats for exposure summaries and claim details are shown in Attachments 3 and 4. Data should be submitted to Mr. Alan Coddington, Assistant Actuary, Mail Drop 3-14, The Mutual Life Insurance Company of New York, 1740 Broadway, New York, New York 10019. The data should be transmitted on 9-track IBM magnetic tape with a density of 1600 BPI and OS Standard Label. Use data-set names of the form ADSTUDNNNMMM, where NNN is your company number and MMM is your reel number. Please specify the vol-

ume serial number of your tape as well as the language used to write your tape (e.g., fortran, cobol).

Please include check totals of exposures, "regular" claims, triple indemnity claims, policies and amounts, separately by sex and size band if data are subdivided by sex and size band. Please supply totals separately for durations 1, 2, 3, and 4 and later. Claim totals should be the same for both exposure input and claim input.

SCHEDULE

Please submit your data by December 1, 1976.

ATTACHMENT 1

QUESTIONNAIRE

- I. Company name and address and name and phone number of contact person.
- II. Which of these exclusions apply to your accidental death benefit for issue years shown below?

1960	1965	1970	1974
	1960	1960 1965	1960 1965 1970

Remarks:

- III. Do you have or have you had a triple indemnity benefit? Is it for deaths which are a result of riding as a passenger on public transportation? If your benefit covers something else or if it has different features, please describe it.
- IV. Does your submission include data on policies where the basic ADB amount is not the same as the policy face amount? If so, please describe how the ADB amount is related to the policy face amount, and estimate what portion of your contribution is affected.
- V. Have you any other comments which might affect the interpretation of the material you are submitting?

ATTACHMENT 2

CAUSE OF DEATH CODES

Committee Code Numbers	Cause Groups	Eighth Revision (1970) International Classification Code Numbers
88	Motor vehicle accidents	E810-E823
89	Aircraft accidents	E840-E845
90	Accidental poisoning	E850-E877
91	Accidental falls	E880-E887
93	Accident caused by fire, explosion of combustible	(E890-E899
	material, hot substance, corrosive liquid steam, and radiation	E923, E924 E926
94	Accident caused by firearm weapons	E922
95	Accidental drowning and submersion	E910
96	All other accidental causes, including self-inflicted injury not specified as intentional	E800-E807 E825-E827 E830-E838 E900-E909 E911-E921 E925 E927-E936 E940-E949
97 98	Suicide and intentional self-inflicted injury Homicide and injury purposely inflicted by other persons (not in war)	(E980–E989 E950–E959 E960–E978
99	Injuries resulting from operations of war	E990-E999

ATTACHMENT 3

INSTRUCTIONS FOR COMPLETION OF EXPOSURE INPUT

Byte	Contents	Instructions
1-3	Company code number	Your company code number is
4	Record type	Record 1 for exposure input.
5-6	Policy anniversary	Record the last two digits of the calendar year in which the policy year of observation ter- minates, i.e., 71, 72, 73, 74, or 75.
7	Duration	For exposures in the first three policy years, record 1, 2, or 3. For ultimate exposures, record 9.
8-9	Age	Record the attained age at the beginning of the policy year of observation.
10	Sex	Record 1 for males, 2 for females, 0 if data are not subdivided by sex.
11	Age basis	Record 0 for durations on the age-nearest- birthday basis. Record 1 for durations on the age-last-birthday basis.
12	Size code	Record 1 if exposure per policy under \$25,000; 2 if \$25,000-\$99,000; 3 if \$100,000 or over; 0 if data are not subdivided by amount or
13	Automatic issue code	if exposure per policy is not known. Record 1 if ADB automatically included; 2 if optional; 3 if automatic and optional bene- fits cannot be separated.
14-25	Exposed (amounts)	Record amount to near \$1. Fill in lead zeros.
25-34	Exposed (number of policies)	Fill in lead zeros. If not available, leave blank.
35-46	Deaths (amounts)	Record amount to near \$1. Fill in lead zeros.
47 - 55	Deaths (number of policies)	Fill in lead zeros. If not available, leave blank.
56-58 59-67	Triple indemnity code	If exposures are subdivided according to whether or not triple indemnity is payable, indicate 000 (not payable) or 100 (payable). If exposures are not subdivided, indicate the estimated percent by amount on which it is payable. For example, if 70% of the amount in bytes 14-25 represents benefits where triple indemnity is payable, punch 070.
	Triple indemnity claims _ (number of policies)	Fill in lead zeros. If not available, leave blank.
68-79	Triple indemnity claims (amount)	Record amount to near \$1. Fill in lead zeros. If exposures include no triple indemnity exposures, leave blank.
80		Leave blank.

ATTACHMENT 4

INSTRUCTIONS FOR COMPLETION OF CLAIM INPUT

Byte	Contents	Instructions
1-3	Company code number	Your company code number is
4	Record type	Record 2 for claim input.
5-6	Policy anniversary	Record the last two digits of the calendar year in which the policy year of death terminates, i.e., 71, 72, 73, 74, or 75.
7	Duration	For deaths in the first three policy years, record 1, 2, or 3. For ultimate deaths, record 9.
8-9	Age	Record the attained age at the beginning of the policy year of death.
10	Sex	Record 1 for males, 2 for females, 0 if data are not subdivided by sex.
11	Age basis	Record 0 for durations on the age nearest birthday basis. Record 1 for durations on the age last birthday basis.
12	Size code	Record 1 if claim per policy under \$25,000; 2 if \$25,000-\$99,999; 3 if \$100,000 or over; 0 if data are not subdivided by amount or if exposure per policy is not known.
13	Automatic issue code	Record 1 if ADB automatically included; 2 if optional; 3 if automatic and optional benefits cannot be separated.
14-25	Deaths (amounts)	Record amount to near \$1. Fill in lead zeros.
26–27	Cause of death	Record cause of death code (see Attachment 2).
28-39	Triple indemnity claims (amount)	Record amount to near \$1.
40-47	Policy number	
4880	•	Leave blank.

APPENDIX III

SUPPLEMENTARY SPECIFICATIONS FOR THE STUDY OF EXPERIENCE UNDER ADB PROVISIONS IN ORDINARY INSURANCE POLICIES BETWEEN 1970 AND 1975 POLICY ANNIVERSARIES

CLARIFICATION OF THE DEFINITION OF A TRIPLE INDEMNITY CLAIM

For the purposes of this study, a triple indemnity claim is one on which twice the usual ADB amount is paid because death was the result of a specific cause such as riding as a passenger on a public conveyance. An ADB benefit equal to twice the face amount of the base policy (or any amount greater than the face amount of the base policy) covering all accidental causes is not to be considered a triple indemnity benefit.

For example, consider a \$10,000 policy with a \$20,000 ADB benefit. The field "Exposed (amounts)" on the exposure record should be coded \$20,000. In the event of accidental death, the field "Deaths (amounts)" on both the exposure and claim records should be coded \$20,000. The field "Triple Indemnity Claims (amount)" on both the exposure and claim records should be blank filled, since there is no triple indemnity benefit. The field "Triple Indemnity Code" on the exposure record should be coded 000.

Now consider a \$10,000 policy with a \$10,000 ADB benefit plus an additional \$10,000 benefit payable if death resulted from riding as a passenger on a public conveyance. The field "Exposed (amounts)" on the exposure record should equal \$10,000. In the event of accidental death resulting from riding as a passenger on a public conveyance, the field "Deaths (amounts)" on both exposure and claim records should be coded \$10,000 and the field "Triple Indemnity Claims (amounts)" on both the exposure and claim records should be coded \$10,000. If the death had resulted from another accidental cause, then the field "Triple Indemnity Claims (amount)" on both exposure and claim records should be zero filled. In either case the field "Triple Indemnity Code" on the exposure record should be coded 100.

August 19, 1976

