REPORT OF THE COMMITTEE ON DISABILITY AND DOUBLE INDEMNITY

EXPERIENCE UNDER ACCIDENTAL DEATH BENEFIT PROVISIONS IN ORDINARY INSURANCE POLICIES BETWEEN 1951 AND 1956 POLICY ANNIVERSARIES

THE Intercompany Double Indemnity Table currently in wide use was developed by the Joint Committee on Mortality from the combined experience of six companies during the period 1926 to 1933.[1] This experience is more than 25 years old. Accidental death rates have changed greatly during that period, both as to their general level and as to their incidence by age. The Committee undertook the new investigation, with the approval of the Board of Governors, in order to provide more modern information on the accidental death experience under double indemnity clauses included in Ordinary insurance policies.

A preliminary invitation to participate in a new intercompany study was sent on October 18, 1956 to companies with more than $300,000,000 of Ordinary double indemnity coverage in force on December 31, 1955. There were 34 such companies. The invitation included an indication of the probable scope and nature of the investigation. Following receipt of the responses to this invitation, the specifications for the study were drawn up and were sent on March 11, 1957 to those companies that had indicated they could contribute to the study. The specifications of the study are reproduced in Appendix B.

Data have been furnished by the 17 companies listed in Table 1. Included in this table are percentages of the total exposures (in terms of amounts of insurance) that were contributed by each of these companies to the various sections of the study. These percentages give an indication of the relative size of the contributions of the different companies.

SCOPE OF THE STUDY

Years of Issue

The basic material for the study was derived from the issues of 1935 to 1940 and 1946 to 1955. The intervening issue years were omitted because of the distorting effect that the unusually high proportion of insurance issued to women during those war years would have had. Supplementary data for years of issue prior to 1935 were obtained from five of the larger companies which issued lifetime benefits in those years and were

[1] See *TASA* XXXV, 381.

therefore in a position to furnish data pertaining to the higher attained ages of coverage.

Years of Observation

The years between 1951 and 1956 policy anniversaries were selected as the period of observation. These were the most recent years available and

TABLE 1

LIST OF CONTRIBUTING COMPANIES AND
PROPORTION OF TOTAL EXPOSURES* CONTRIBUTED BY EACH
TO VARIOUS SECTIONS OF STUDY

COMPANY	TOTAL DATA			SPECIAL ANALYSES, ALL YEARS OF ISSUE	
	Issue Years 1935-40, 1946-55	Issue Years before 1935	All Issue Years	By Sex	By Sex and Policy Size
Prudential	28.3%	31.0%	28.8%	48.7%	
Metropolitan	23.2	2.8	20.0		
New York Life	13.6	37.8	17.1	21.4	42.8%
Equitable, New York	10.2	13.6	10.7	11.6	23.2
Mutual Life, New York	4.4	14.8	6.0		
John Hancock	4.4		3.7	6.3	12.6
New England Mutual	2.3		2.0	3.3	6.7
Connecticut Mutual	2.3		1.9		
Aetna	2.2		1.9		
Penn Mutual	1.8		1.5	2.6	5.2
Sun Life, Canada	1.6		1.3	2.2	4.4
National Life and Accident	1.3		1.1		
Massachusetts Mutual	1.2		1.0	1.7	3.4
Connecticut General	1.0		.8		
Bankers	.9		.8	1.3	
Union Central	.7		.6		
Equitable, Iowa	.6		.5	.9	1.7
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Total Exposure (in $1,000 units)	$116,298,977	$21,471,836	$137,770,813	$81,357,354	$40,697,345
Total Claims Number of Policies	12,396	3,952	16,348	8,345	3,948
Amount Paid	$ 39,547,069	$11,152,179	$50,699,248	$28,757,595	$15,256,663

* In terms of amounts of insurance. All companies other than Metropolitan and Aetna also supplied data by policies. Prudential's data for policy year one were not included in the study because sufficiently accurate exposures were not available.

The contributions of a few companies did not cover the full observation period or all years of issue. Two companies submitted data for the period between 1952 and 1956 anniversaries only, one for issues of 1946 and later only, and three for premium paying business only. Some of the companies contributing to the special analyses were able to furnish subdivisions of their data by sex, or by sex and policy size, for only part of their total data entering the basic study.

provided a sufficient volume of data to give significant results. The Korean War was being waged from the beginning of this observation period until July 1953, but this was not deemed to invalidate the significance of the findings because companies generally excluded accidental deaths as a result of service in the military forces of a country at war.

Some increase of the double indemnity claims might be expected because training accidents were covered by about half of the companies. In general, however, war deaths were not considered to have a material effect on the level of claims incurred.

Other Features of the Data

Further details regarding the material furnished will be found in the specifications of the study as reproduced in Appendix B. The following points may be of special interest:

1. The investigation was in general confined to double indemnity clauses issued at standard rates. Several companies were not able to exclude substandard clauses, particularly when attached to standard policies. In the case of such companies, when the claims on substandard clauses did not exceed 5% of the company's total claims, the contribution was included without adjustment. When the proportion was in excess of 5%, as was true for five companies, the claims on substandard clauses were reduced by applying a factor equal to the reciprocal of the rating. For example, claims on clauses which were issued at $1\frac{1}{2}$ times the standard premium rate were included in the study for 2/3 of their actual amount.
2. Clauses automatically incorporated in life insurance policies were excluded from the investigation.
3. Companies were given the option of including clauses added after the issuance of a policy.
4. Sampling methods were permitted in the derivation of a company's data, but the contribution was translated to the equivalent of a 100% basis before transmission.

No attempt was made to differentiate the companies according to the liberality of their clauses or of their administration. There are obvious difficulties in arriving at any such differentiation, and in any case it was questionable that significant subdivisions could be established in this way. Information was obtained from the companies as to the exclusions contained in their double indemnity clauses, and this information is summarized later in the report. The over-all results for each company were also analyzed separately to measure the variation in the experience of the individual companies. The findings in this regard are discussed later.

Subdivisions of the Analysis

The data for each of policy years 1, 2 and 3 were submitted separately by age at issue, and the data for later durations were combined and submitted by attained age.

The experience by amount of insurance was furnished by all companies. Data by numbers of policies were also requested, and 15 of the 17 companies were able to comply with this request.

Ten of the contributing companies were able to break their contribution down by sex. This permitted separate analyses to be made of the experience on male lives and female lives for a portion of the total contribution.

An effort was made to investigate the experience by size of policy. This was regarded as an index of how the experience might be correlated with the total amount of accidental death benefit on a policyholder's life. Three amount subdivisions were specified, *i.e.*, less than $5,000, $5,000 to $19,999, and $20,000 and over. Only eight of the companies were in a position to subdivide their material by policy size and sex, and this limited the significance of the findings in this area, particularly since the two largest contributors were not able to make the subdivision.

Information as to cause of death was also requested from all 17 companies, pursuant to the code subdivisions listed in Appendix B.

Volume of Data

Statistics as to the volume of exposures and claims appear at the bottom of Table 1. For all years of issue combined, the exposure came to almost $138 billion, while the claims were 16,348 in number and $50,699,-248 in amount. In the previous intercompany investigation the issues of 1918–32 observed between 1926 and 1933 anniversaries produced $42,-045,000 in claims on an exposed to risk of $64½ billion. Thus with more than double the exposure, the current investigation's claims were only 20% higher than those of the earlier study.

RESULTS OF THE INVESTIGATION

Table 2 summarizes the data of the present investigation for attained age groups and relates the claims to the 1926–33 Intercompany Table. All durations and both sexes have been combined. The table shows the amount exposed, the number and amount of claims,[2] and the ratio of the claims by amount to the claims expected on the basis of the 1926–33 Table.

The improvement in the claim rates as evidenced by the ratios in Table 2 has been substantial at all ages. The over-all ratio is 49%, but there is considerable variation by attained age. Where the volume of claims is significant, the ratios are lowest in the age range from 50 to 69.

[2] Throughout the report the claim amounts used were the amounts actually paid. In the case of compromise settlements, these amounts were lower than the corresponding exposed to risk amounts.

TABLE 2

EXPERIENCE UNDER ORDINARY ACCIDENTAL DEATH BENEFITS
BETWEEN 1951 AND 1956 POLICY ANNIVERSARIES
RELATIVE TO 1926–33 INTERCOMPANY DOUBLE INDEMNITY TABLE*
ALL POLICY DURATIONS, BOTH SEXES COMBINED

ATTAINED AGE	EXPOSURE (in $1,000 Units)	ACTUAL CLAIMS		MORTALITY RATIO BY AMOUNT
		Number of Policies	Amount Paid	
		All Years of Issue in Study		
0–4............	$ 4,237	0	$ 0	....
5–9............	252,350	25	58,050	31%
10–14...........	927,399	96	115,232	16
15–19...........	3,642,785	870	2,027,163	69
20–24...........	9,168,336	1,765	4,685,491	75
25–29...........	15,070,949	1,440	4,566,231	63
30–34...........	19,373,037	1,685	5,988,599	66
35–39...........	21,254,748	1,816	5,983,159	53
40–44...........	20,346,985	1,848	6,152,868	48
45–49...........	16,988,899	1,803	6,015,785	48
50–54...........	12,414,990	1,471	4,538,950	37
55–59...........	8,589,133	1,209	3,737,804	37
60–64...........	5,161,709	878	2,551,238	33
65–69...........	2,613,434	575	1,793,337	37
70–74...........	1,314,525	428	1,278,950	43
75–79...........	514,257	285	791,742	47
80–84...........	120,550	133	369,324	60
85–89...........	12,269	21	45,325	49
90–94...........	213	0	0	....
95–99...........	8	0	0	....
To 34...........	$ 48,439,093	5,881	$17,440,766	66%
35–44...........	41,601,733	3,664	12,136,027	50
45–54...........	29,403,889	3,274	10,554,735	43
55 and over......	18,326,098	3,529	10,567,720	38
All...........	$137,770,813	16,348	$50,699,248	49%
		Issue Years 1935–40, 1946–55		
To 34...........	$ 48,366,143	5,862	$17,417,748	66%
35–44...........	39,769,129	3,352	11,553,168	50
45–54...........	22,316,637	2,289	8,099,911	44
55 and over......	5,847,068	893	2,476,242	33
All...........	$116,298,977	12,396	$39,547,069	53%
		Issue Years before 1935		
To 34...........	$ 72,950	19	$ 23,018	66%
35–44...........	1,832,604	312	582,859	52
45–54...........	7,087,252	985	2,454,824	39
55 and over......	12,479,030	2,636	8,091,478	39
All...........	$ 21,471,836	3,952	$11,152,179	40%

* Including extensions below age 15 and for ages 95–99 as developed by the Actuarial Society of America and the American Institute of Actuaries for the reserve tables published in 1947 based on the 1926–33 Intercompany Table combined with CSO Mortality.

TABLE 3

GRADUATED 1951–56 ACCIDENTAL DEATH CLAIM RATES

(Aggregate experience based on amount of claims paid, extended
to include rates at ages 1 through 100)

COMPARED TO 1926–33 INTERCOMPANY TABLE AS EXTENDED

AGE	CLAIM RATE PER 1,000		RATIO OF 1951–56 TO 1926–33	AGE	CLAIM RATE PER 1,000		RATIO OF 1951–56 TO 1926–33
	1951–56	1926–33			1951–56	1926–33	
1......	.424	.875	48%	51......	.362	.936	39%
2......	.347	.860	40	52......	.367	.999	37
3......	.298	.845	35	53......	.374	1.050	36
4......	.264	.830	32	54......	.383	1.088	35
5......	.239	.815	29	55......	.395	1.115	35
6......	.220	.800	28	56......	.409	1.146	36
7......	.207	.767	27	57......	.425	1.180	36
8......	.202	.733	28	58......	.442	1.244	36
9......	.198	.699	28	59......	.460	1.310	35
10......	.203	.662	31	60......	.480	1.378	35
11......	.212	.644	33	61......	.502	1.448	35
12......	.230	.662	35	62......	.528	1.519	35
13......	.260	.796	33	63......	.557	1.589	35
14......	.301	.887	34	64......	.589	1.656	36
15......	.366	.882	41	65......	.622	1.720	36
16......	.490	.854	57	66......	.656	1.783	37
17......	.556	.827	67	67......	.692	1.844	38
18......	.578	.801	72	68......	.730	1.906	38
19......	.583	.776	75	69......	.771	1.974	39
20......	.575	.752	76	70......	.819	2.053	40
21......	.554	.728	76	71......	.878	2.148	41
22......	.519	.697	74	72......	.952	2.264	42
23......	.471	.654	72	73......	1.046	2.409	43
24......	.420	.605	69	74......	1.166	2.586	45
25......	.377	.555	68	75......	1.315	2.801	47
26......	.345	.509	68	76......	1.494	3.059	49
27......	.324	.473	68	77......	1.703	3.362	51
28......	.309	.449	69	78......	1.943	3.711	52
29......	.300	.439	68	79......	2.216	4.100	54
30......	.294	.438	67	80......	2.521	4.519	56
31......	.290	.447	65	81......	2.852	4.956	58
32......	.287	.464	62	82......	3.206	5.405	59
33......	.286	.481	59	83......	3.584	5.867	61
34......	.286	.494	58	84......	3.988	6.363	63
35......	.286	.502	57	85......	4.419	6.926	64
36......	.287	.511	56	86......	4.878	7.585	64
37......	.289	.523	55	87......	5.367	8.364	64
38......	.291	.544	53	88......	5.886	9.270	63
39......	.293	.571	51	89......	6.437	10.278	63
40......	.295	.598	49	90......	7.022	11.344	62
41......	.299	.621	48	91......	7.642	12.411	62
42......	.305	.637	48	92......	8.298	13.408	62
43......	.313	.649	48	93......	8.991	14.259	63
44......	.322	.660	49	94......	9.723	14.892	65
45......	.331	.675	49	95......	10.495	15.265	69
46......	.339	.696	49	96......	11.308	15.450	73
47......	.346	.726	48	97......	12.164	15.590	78
48......	.351	.765	46	98......	13.064	15.710	83
49......	.355	.815	44	99......	14.009	15.820	89
50......	.358	.873	41	100......	15.000	....	....

Separate sections of the table are devoted to the issues of 1935 and later and to the issues which preceded 1935, the analysis being in broad age groups. The ratios in the two sections are quite similar for the corresponding age groups, but because of the very different weighting of the experience by attained age, the over-all ratio for the issue years before 1935 is substantially lower than that for the later issue years.

Graduated Claim Rates

To facilitate the analysis of the various subdivisions of the study, graduated claim rates by amount were derived and are presented in Table 3. They are based on the total contribution covering all durations,

TABLE 4

AGGREGATE EXPERIENCE RELATIVE TO GRADUATED
1951–56 RATES IN TABLE 3

ATTAINED AGE	MORTALITY RATIOS BY AMOUNT		
	Issue Years 1935–40, 1946–55	Issue Years before 1935	All Issue Years
To 34............	100%	110%*	100%
35–44............	98	104	98
45–54	103	96	101
55 and over......	93	101	99
All............	100%	100%	100%

* Based on 19 claims. Each of the other ratios shown is based on more than 300 claims.

and thus form an aggregate table. All years of issue were combined in the derivation of this table because of the similarity of the results for the different years of issue examined. Due to the paucity of data at the young and high ages, it was necessary to fall back on population data as a basis for an extension of the graduated rates to those ages.

The graduation process and the method of extension are described in Appendix A. Table 4 summarizes the relationship of the actual experience to the graduated rates for each set of issue years separately and for all years combined.

Also shown in Table 3, for comparison purposes, are the rates of the 1926–33 Intercompany Table (as extended below age 15 and above age 94 in connection with the publication in 1947 of the reserve tables based on the 1926–33 Table combined with CSO mortality). Ratios of the 1951–56 to the 1926–33 claim rates are also included in Table 3.

The Committee wishes to emphasize that the graduated claim rates for the present study were produced for analysis purposes only, and not as a table deemed suitable for premium or valuation purposes. The claim rates represent the actual experience during the 1951 to 1956 observation period for the particular group of lives studied, with some extension at the low and high ages. They have no loading in them for fluctuations or contingencies. As will be brought out later, there were significant variations from the over-all experience for many of the contributing companies, as well as by policy duration and sex. It is probable, also, that the 1951–56 period was 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.

Causes of Accidental Death

The companies were requested to give the cause of death on each claim card. The causes studied were derived from the 1950 Code for Causes of Death (see *TSA* I, 621). They appear in Appendix B, together with the equivalent codes of the Sixth Revision of the International Lists of Diseases and Causes of Death.

The distribution of the amount of claims by cause of accidental death for four age groups and for all ages combined appears in Table 5. Motor vehicle accidents were by far the most important cause, accounting for 55% of the claims when all ages are considered together. Accidental falls came next in order, and represented almost 9% of the total claims. Drowning and aircraft accidents each accounted for about 5% of the claims. No other cause produced as much as $3\frac{1}{2}\%$ of the claims.

There are some interesting variations by attained age in the proportions attributable to the individual causes of death. Motor vehicle accidents comprised 63% of the claims at ages under 35, with smaller proportions applying at higher ages. The proportions due to accidental falls increase with age, rising to over 20% for ages 55 and over. For ages 70 and over, the proportion was 42%. Drowning death proportions are in the range of 4% to 6% for the four broad age groups shown in the table, but it may be of interest to note that the proportion was 11% for attained ages under 20. Deaths due to accidental poisoning by solid or liquid substances took a heavier toll at the middle age range of 35 to 54 than at the low and high ages. This was true for the rates of death as well as for the percentages of the total. Some other causes of death also show high percentages at the middle age range, but the rates of deaths themselves do not display the same hump.

TABLE 5

DISTRIBUTION BY CAUSE OF DEATH, AGGREGATE EXPERIENCE, ALL COMPANIES
BASED ON AMOUNT OF CLAIMS PAID

CAUSE OF DEATH	ATTAINED AGE				
	To 34	35-44	45-54	55 and Over	All
	Percentage Distribution				
Motor Vehicle Accidents...............	63.2%	54.7%	49.3%	50.0%	55.2%
Accidental Falls.......................	3.7	5.0	9.5	20.8	8.8
Accidental Drowning and Submersion (ex-cluding Water Transport Accidents)....	5.6	4.3	5.7	4.3	5.1
Aircraft Accidents.....................	4.3	5.3	5.6	3.5	4.7
Accident Caused by Firearm............	2.5	4.6	4.8	2.2	3.4
Accident Caused by Fire, Explosion, etc...	2.6	4.0	3.6	3.3	3.3
Homicide..............................	2.5	4.0	3.5	2.5	3.1
Water Transport Accidents.............	3.3	3.5	2.9	2.0	3.0
Accident Caused by Machinery..........	1.9	2.0	2.3	2.0	2.0
Accident Caused by Electric Current.....	2.6	1.8	1.3	0.7	1.8
Blow from Falling Object...............	1.5	1.7	1.3	1.0	1.4
Accidental Poisoning by Gases and Vapors	0.8	0.9	1.0	0.7	0.9
Suffocation............................	0.5	0.3	1.6	0.9	0.8
Accidental Poisoning by Solid and Liquid Substances........................	0.2	0.9	1.5	0.2	0.6
Suicide................................	0.4	0.4	0.6	0.5	0.5
All Other Claims.......................	4.4	6.6	5.5	5.4	5.4
All...............................	100.0%	100.0%	100.0%	100.0%	100.0%
	Amount of Claims Paid (in $1,000 Units)				
Motor Vehicle Accidents...............	$11,008	$ 6,621	$ 5,185	$ 5,282	$28,096
Accidental Falls.......................	645	601	1,001	2,197	4,444
Accidental Drowning and Submersion (ex-cluding Water Transport Accidents)....	974	526	604	458	2,562
Aircraft Accidents.....................	752	645	595	366	2,358
Accident Caused by Firearm............	438	563	504	230	1,735
Accident Caused by Fire, Explosion, etc...	458	484	380	353	1,675
Homicide..............................	431	484	371	262	1,548
Water Transport Accidents.............	583	426	310	211	1,530
Accident Caused by Machinery..........	339	241	238	214	1,032
Accident Caused by Electric Current.....	460	219	140	74	893
Blow from Falling Object...............	265	212	135	106	718
Accidental Poisoning by Gases and Vapors	138	114	110	79	441
Suffocation............................	82	37	170	93	382
Accidental Poisoning by Solid and Liquid Substances........................	35	104	161	17	317
Suicide................................	66	53	65	53	237
All Other Claims.......................	767	806	585	573	2,731
All...............................	$17,441	$12,136	$10,554	$10,568	$50,699

An analysis of the distribution of claims by number of policies was also made but has not been included in the report because the percentages are in general very similar to those by amount. One cause that showed a consistent excess by amounts over numbers was aircraft accidents. The average size of aircraft accident claim was $4,525 as against an over-all average of $3,101. There was a substantial excess of average size for this cause in each age group. This was not true of any other cause of death.

Comparison with Table C in *TASA* XXXV, page 387, reveals that the distribution by cause has changed substantially since the 1918–1933 period which was covered by that earlier table. In the earlier study motor vehicle accidents accounted for about 38% of the claims compared with the present 55% of the claims. Drowning and falls were the second and third most important causes in the earlier study; this was true in the present study but in reverse order. The proportion is slightly higher for accidental falls (8.8% versus 7.9%). Drowning deaths have a lower proportion (5.1% versus 9.5%), but the decrease may be partly accounted for by a change in the way in which water transport accidents were handled beginning with the 1929 revision of the causes of death. They were placed in a separate subdivision then, but prior to 1929 these accidents were included with drowning. Aircraft accidents, the fourth most important cause of death, were not separately reported in the previous study and now account for almost 5% of the claims. There is a general decrease in the other causes in terms of the percentage of the whole. Some of this decrease is due to the greater importance of motor vehicle accidents in the present era.

Claims paid on cases reported as suicide amounted to .5% of the total, which is a substantial decrease from the 1.6% ratio in the earlier study. This is not surprising, as the last study included several depression years in the observation period and those years were marked by high suicide rates. Suicides are excluded by the policy terms from accidental death coverage, but companies are not always successful in establishing proof of suicide, and in some states the statutory provisions do not permit exclusions of suicides under certain conditions.

Analysis by Policy Duration

Table 6 shows, for policy years 1, 2 and 3 separately and for policy years 4 and later combined, mortality ratios by amounts of insurance for the issues of 1935–40 and 1946–55 in relation to the graduated claim rates of Table 3. These ratios are shown for several attained age groups.

The results displayed in Table 6 run counter to the report in *TASA* XXXV, which found no selection either for or against the companies in

the claim rates analyzed by policy duration. In the present instance policy years 1 and 3 have ratios above 100% in each age group under 55, with the age group 45–54 especially high. On the other hand, policy year 2 is below 100% in all age groups.

The explanation for the higher ratio in the first policy year may well lie in antiselection, possibly including the simulation of accidental death conditions by persons who actually committed suicide. In this connection,

TABLE 6

ANALYSIS BY POLICY DURATION

EXPERIENCE OF ALL COMPANIES,† YEARS OF ISSUE 1935–40 AND 1946–55

Mortality Ratios Based on Amount of Insurance Relative to
Graduated 1951–56 Rates in Table 3

POLICY YEAR	ATTAINED AGE				
	To 34	35 to 44	45 to 54	55 and Over	All
	Mortality Ratios				
1............	107%	103%	125%	*	107%
2............	95	93	93	61%	94
3............	103	101	119	97	105
4 and over....	99	98	101	95	99
All........	100%	98%	103%	93%	100%
	Number of Claims (Policies)				
1............	800	170	84	2	1,056
2............	838	217	108	11	1,174
3............	748	201	105	21	1,075
4 and over....	3,476	2,764	1,992	859	9,091
All........	5,862	3,352	2,289	893	12,396
	Amount of Claims Paid				
1............	$ 2,963,575	$ 1,065,195	$ 543,866	$ 4,698	$ 4,577,334
2............	3,151,005	1,142,003	508,683	35,359	4,837,050
3............	2,672,599	1,113,011	622,192	64,834	4,472,636
4 and over....	8,630,569	8,232,959	6,425,170	2,371,351	25,660,049
All........	$17,417,748	$11,553,168	$8,099,911	$2,476,242	$39,547,069

† As indicated in a footnote to Table 1, the Prudential's data for policy year one were not included in the study.

* Mortality ratios not shown since number of claims is less than 10.

it is interesting to note that analysis of the causes of death shows that motor vehicle deaths incurred in the first policy year were high in each age group by comparison with the deaths expected on the basis of the aggregate experience. By amounts, the ratio was 116% for ages under 35, 113% for ages 35–44 and 118% for ages 45–54. There were only 2 deaths at ages 55 and over. No other single cause with a significant number of deaths stood out. (The "expected" deaths by cause were derived by applying the percentage distributions of Table 5 for each of the four age groups to the total expected claims at each duration for the corresponding age group.)

The high ratio in policy year 3 is puzzling. There is the possibility that some policyholders are postponing suicides which are made to look like accidents until the suicide limitation period of the policies have run out in order not to jeopardize the payment of the basic face amounts, but this is not apparent from an analysis of the causes of death. Automobile accidents did not stand out in the same degree for this policy year, and no pattern of "suicide antiselection" was disclosed by the other causes of death. Moreover, further analysis of the experience by numbers of policies did not produce the same excess of mortality ratio for policy year 3 as by amount of insurance.

Policies versus Amounts

Data by policies as well as by amount of insurance were contributed by 15 companies (14 for the first policy year). Comparison of policy versus amount mortality for these companies is made in Table 7, using broad attained age groups.

It would appear from this table that in the first policy year the experience by amount is very similar to that by number of policies. For the later policy years there is a decided excess in the mortality ratios by amount over the ratios by policies for all ages combined. When the age groups are examined separately, it is seen that the excess decreases with advancing age, and that the ratios by policies become higher than the ratios by amount for ages 55 and over.

Table 7 suggests antiselection by amount of insurance. This is confirmed by the claim experience by size group and sex which is presented in Table 11 and is discussed on pages 60–61 and 65–66. The mortality ratios are there found to increase with the size of policy.

In interpreting Table 7 it is well to keep in mind that although the expected deaths are based upon the graduated claim rates derived from the experience of all 17 contributing companies, the actual deaths and the exposed to risk to which the graduated rates were applied pertain only to

the companies which had policy data available. As an interesting sidelight it may be noted that the mortality ratio by amount for the first policy year is 112% for these companies, a figure well above the 107% which emerged for all companies.

Analysis by Sex

The material of the ten companies which were able to break their material down by sex of the insured is analyzed in Table 8 for broad age

TABLE 7

ANALYSIS BY NUMBER OF POLICIES AND BY AMOUNT OF INSURANCE
EXPERIENCE OF 15 COMPANIES, ALL YEARS OF ISSUE COMBINED
Mortality Ratios Expressed Relative to Graduated 1951–56 Rates in Table 3

ATTAINED AGE	POLICY YEAR 1		POLICY YEAR 2 AND HIGHER		ALL POLICY YEARS	
	Number	Amount	Number	Amount	Number	Amount
	Mortality Ratios					
To 34.......	114%	115%	90%	103%	92%	105%
35–44.......	114	110	88	99	89	99
45–54.......	109	114	95	99	95	100
55 and over.	*	*	103	99	103	99
All.......	113%	112%	94%	100%	95%	101%
	Claims (Amounts in $1,000 Units)					
To 34.......	468	$1,998	3,430	$11,072	3,898	$13,070
35–44.......	120	797	2,610	8,598	2,730	9,395
45–54.......	47	347	2,540	8,159	2,587	8,506
55 and over.	2	5	3,180	9,729	3,182	9,734
All.......	637	$3,147	11,760	$37,558	12,397	$40,705

* Ratios not shown where number of claims is less than 10.

groups. Since all of these companies provided policy data along with amount data, mortality ratios by both policies and amount are shown in this table. The expected deaths were based upon the graduated 1951–56 claim rates of Table 3.

The over-all mortality ratio for females is 36% of the corresponding ratio for males by policies and 41% by amount. These percentages vary considerably by attained age, however, increasing from under 30% at the young ages to 60% or over at the upper ages. The over-all claim ratio

on male lives is 107% of the expected deaths based on the mixed male-female experience.

Analysis of the causes of death for each sex reveals for males a fairly general excess of claims for each cause over the "expected" calculated by applying the Table 5 percentages to the expected claims underlying Table 8. Aircraft accidents and accidental falls were on the high side (116% and

TABLE 8

ANALYSIS BY SEX

EXPERIENCE OF 10 COMPANIES, ALL YEARS OF ISSUE COMBINED

Mortality Ratios Expressed Relative to Graduated 1951–56 Rates in Table 3

ATTAINED AGES	MALES		FEMALES		RATIO OF FEMALE TO MALE	
	By Number of Policies	By Amount	By Number of Policies	By Amount	By Number of Policies	By Amount
		MORTALITY RATIOS Policy Year 1				
To 34.........	138%	125%	40%	33%	29%	26%
35–44.........	104	104	*	*	....	....
45–54.........	118	134	*	*	....	....
55 and over....	*	*	*	*	....	....
All.........	128%	119%	44%	51%	34%	43%
		Policy Year 2 and Higher				
To 34.........	115%	115%	27%	32%	23%	28%
35–44.........	100	105	39	45	39	43
45–54.........	105	104	53	68	50	65
55 and over....	99	93	66	55	67	59
All.........	106%	106%	38%	44%	36%	42%
		All Policy Years				
To 34.........	117%	116%	28%	32%	24%	28%
35–44.........	100	105	39	48	39	46
45–54.........	105	105	54	70	51	67
55 and over....	98	92	66	55	67	60
All.........	107%	107%	38%	44%	36%	41%

* Mortality ratios not shown since number of claims is less than 10.

TABLE 8—*Continued*

ATTAINED AGES	MALES		FEMALES	
	Number	Amount	Number	Amount
CLAIMS (Amounts in $1,000 Units) Policy Year 1				
To 34	315	$ 1,535	34	$ 54
35–44	73	566	7	36
45–54	33	297	4	24
55 and over	0	0	1	1
All	421	$2,398	46	$ 115
Policy Year 2 and Higher				
To 34	2,731	$ 9,428	282	$ 457
35–44	1,840	6,800	207	326
45–54	1,465	5,372	176	343
55 and over	1,041	3,347	136	172
All	7,077	$24,947	801	$1,298

111%, respectively) relative to the over-all ratio of 107% for male lives. Among women, the ratios to the "expected" were generally low, in keeping with the over-all ratio of 44%, except for accidents caused by fire, explosion, etc., and homicides, which with 66 and 55 claims, respectively, had ratios of 96% and 85%. These are not far from the male experience. Causes of death which were particularly low for women were drowning and aircraft accidents, but the number of claims was quite limited.

Table 9 has been prepared to show the relationship of the volume of data on female lives to the total volume on male and female lives combined. The percentages in this table are based on the exposed to risk data underlying Table 8. The proportion on females decreases steadily with advancing age, and is greater by number of policies than by amount of insurance because of the lower average size policy written on women. For all ages together the female proportion is 24% by number of policies and 11% by amount of insurance.

The ten companies which contributed material to this section of the study displayed a considerable variation in the proportion of their exposed to risk which was on female lives. For all ages combined, four of the

companies had female proportions ranging from 22% to 27% by number of policies and 8% to 14% by amount of insurance. Five companies had proportions of 13% to 19% by number of policies and 6% to 9% by amount of insurance. In the case of one company (with a relatively small amount of data) female lives accounted for 8% of the total by number of policies and 4% by amount of insurance. Different age distributions in new business sales probably account for some of the variations among companies in these figures.

To provide a standard of comparison for those companies which desire to analyze their experience on male lives separately from that on female

TABLE 9

PROPORTIONS OF TOTAL EXPOSED TO RISK ENTERING
TABLE 8 WHICH ARE ON FEMALE LIVES

Attained Ages	By Number of Policies	By Amount of Insurance
Under 15	35%	25%
15–24	35	19
25–34	26	11
35–44	22	10
45–54	19	9
55–64	18	9
65–74	14	7
75 and over	11	6
All Ages	24%	11%

lives, a table of graduated claim rates on male lives only has been prepared and is presented in Table 10. The graduation process is described in Appendix A. It should be noted that this table was derived by applying to the aggregate experience of the 17 companies on which Table 3 is based graduated ratios of the claim rates on males to the claim rates on males and females combined of only 10 companies. The claim rates in Table 10 tend to approach those of Table 3 with advancing age, because of decreasing proportions of female lives, and agree with those of Table 3 for ages 84 and over.

Analysis by Size Group and Sex

As a further refinement of the investigation, the experience of eight companies that were in a position to furnish data subdivided by size group and sex is presented in Table 11. Because of the wide disparity in

the ratios for the two sexes and the substantial differences in the size of
policy applied for by men and women, it was considered necessary to make
the "two-way" analysis and to eliminate some material which included
a subdivision by size of policy but not by sex.

The ratios in Table 11 display a general upward trend as the size of

TABLE 10

GRADUATED 1951–56 MALE ACCIDENTAL DEATH CLAIM RATES BASED ON
THE AGGREGATE MALE EXPERIENCE OF 10 COMPANIES, BY
AMOUNT OF CLAIMS PAID

EXTENDED TO INCLUDE RATES AT AGES 1 THROUGH 100

Age	Claim Rate per 1,000	Age	Claim Rate per 1,000	Age	Claim Rate per 1,000
1	.466	35	.303	68	.742
2	.382	36	.304	69	.783
3	.329	37	.306	70	.830
4	.293	38	.307	71	.889
5	.267	39	.309	72	.963
6	.248	40	.310	73	1.058
7	.236	41	.313	74	1.178
8	.235	42	.318	75	1.327
9	.233	43	.326	76	1.506
10	.241	44	.334	77	1.715
11	.252	45	.342	78	1.955
12	.274	46	.350	79	2.227
13	.310	47	.357	80	2.531
14	.358	48	.361	81	2.861
15	.434	49	.365	82	3.212
16	.579	50	.368	83	3.588
17	.656	51	.372	84	3.988
18	.680	52	.377	85	4.419
19	.685	53	.385	86	4.878
20	.675	54	.396	87	5.367
21	.649	55	.409	88	5.886
22	.605	56	.424	89	6.437
23	.546	57	.441	90	7.022
24	.482	58	.458	91	7.642
25	.428	59	.476	92	8.298
26	.387	60	.495	93	8.991
27	.359	61	.517	94	9.723
28	.339	62	.541	95	10.495
29	.326	63	.569	96	11.308
30	.317	64	.600	97	12.164
31	.311	65	.634	98	13.064
32	.306	66	.668	99	14.009
33	.304	67	.704	100	15.000
34	.304				

TABLE 11

ANALYSIS BY POLICY SIZE GROUP AND SEX
EXPERIENCE OF 8 COMPANIES, ALL YEARS OF ISSUE COMBINED
RATIOS EXPRESSED RELATIVE TO GRADUATED 1951–56 RATES IN TABLE 3

Attained Ages	Policy Size	Number of Claims (Policies)			Mortality Ratio by Number of Policies			Mortality Ratio by Amount		
		Policy Year			Policy Year			Policy Year		
		1	2 and Higher	All	1	2 and Higher	All	1	2 and Higher	All
					MALES					
To 34	Less than $5,000	135	857	992	134%	132%	133%	134%	124%	126%
	$5,000 to $19,999	167	406	573	143	128	132	129	128	128
	$20,000 and over	4	16	20	*	179	144	*	185	147
	All	306	1,279	1,585	137%	131%	133%	125%	130%	129%
35–44	Less than $5,000	21	533	554	91%	100%	100%	81%	95%	95%
	$5,000 to $19,999	45	326	371	111	118	117	112	117	117
	$20,000 and over	5	31	36	*	185	166	*	170	149
	All	71	890	961	103%	108%	107%	101%	118%	116%
45–54	Less than $5,000	9	404	413	*	110%	109%	*	104%	104%
	$5,000 to $19,999	17	249	266	113%	121	120	122%	108	109
	$20,000 and over	5	16	21	*	114	128	*	92	102
	All	31	669	700	113%	114%	114%	130%	105%	107%

TABLE 11—*Continued*

		NUMBER OF CLAIMS (POLICIES)			MORTALITY RATIO BY NUMBER OF POLICIES			MORTALITY RATIO BY AMOUNT		
ATTAINED AGES	POLICY SIZE	Policy Year			Policy Year			Policy Year		
		1	2 and Higher	All	1	2 and Higher	All	1	2 and Higher	All
MALES—*Continued*										
55 and over.........	Less than $5,000	0	188	188	*	111%	110%	*	106%	105%
	$5,000 to $19,999	0	92	92	*	111	109	*	93	91
	$20,000 and over	0	5	5	*	*	*	*	*	*
	All	0	285	285	*	111%	110%	*	97%	95%
All............	Less than $5,000	165	1,982	2,147	122%	115%	116%	122%	109%	110%
	$5,000 to $19,999	229	1,073	1,302	132	121	123	123	116	118
	$20,000 and over	14	68	82	112	153	144	94	140	130
	All	408	3,123	3,531	127%	118%	119%	117%	117%	117%
FEMALES										
To 34	Less than $5,000	31	118	149	40%	30%	32%	38%	31%	32%
	$5,000 to $19,999	2	16	18	*	101	80	*	91	71
	$20,000 and over	0	0	0	*	*	*	*	*	*
	All	33	134	167	39%	33%	34%	33%	40%	38%

* Mortality ratios not shown where number of claims is less than 10.

TABLE 11—*Continued*

ATTAINED AGES	POLICY SIZE	NUMBER OF CLAIMS (POLICIES)			MORTALITY RATIO BY NUMBER OF POLICIES			MORTALITY RATIO BY AMOUNT		
		Policy Year			Policy Year			Policy Year		
		1	2 and Higher	All	1	2 and Higher	All	1	2 and Higher	All
					FEMALES—*Continued*					
35–44	Less than $5,000	4	92	96	*	43%	43%	*	46%	45%
	$5,000 to $19,999	2	12	14	*	115	112	*	128	119
	$20,000 and over	1	0	1	*	*	*	*	*	*
	All	7	104	111	*	46%	47%	*	59%	63%
45–54	Less than $5,000	2	68	70	*	53%	53%	*	56%	57%
	$5,000 to $19,999	2	12	14	*	124	130	*	137	149
	$20,000 and over	0	1	1	*	*	*	*	*	*
	All	4	81	85	*	58%	59%	*	81%	84%
55 and over	Less than $5,000	1	50	51	*	76%	77%	*	65%	65%
	$5,000 to $19,999	0	3	3	*	*	*	*	*	*
	$20,000 and over	0	0	0	*	*	*	*	*	*
	All	1	53	54	*	75%	76%	*	61%	60%
All	Less than $5,000	38	328	366	42%	41%	41%	39%	41%	41%
	$5,000 to $19,999	6	43	49	*	105	97	*	109	100
	$20,000 and over	1	1	2	*	*	*	*	*	*
	All	45	372	417	44%	44%	44%	52%	54%	54%
					BOTH SEXES					
All	All	453	3,495	3,948	107%	100%	101%	111%	110%	110%

64

. . . . of claims is less than 10.

policy increases. Thus for male lives the ratio by amount of claims for all ages combined is 110% for the under $5,000 group, 118% for the $5,000 to $19,999 group and 130% for the $20,000 and over group. The ratios by number of policies are higher in each instance, progressing from 116% to 123% to 144% for the three size groups. Payments of less than the face amount under compromised claims are a possible explanation for this relationship between amount and number ratios.

The data for women are much more limited and therefore must be interpreted with caution. The increase from 41% in the under $5,000 group to 100% in the $5,000 to $19,999 group is nevertheless noteworthy

TABLE 12

ACCIDENTAL DEATH CLAIM RATES
UNDER COMMERCIAL ACCIDENT POLICIES
BETWEEN 1948 AND 1952 POLICY
ANNIVERSARIES, MALES ONLY*

ATTAINED AGE	PRINCIPAL SUM UNDER $10,000		PRINCIPAL SUM $10,000 AND OVER	
	Claims	Annual Claim Rate by Number (per 1,000)	Claims	Annual Claim Rate by Number (per 1,000)
0–39............	49	.36	10	.51
40–49...........	87	.41	25	.60
50–59...........	111	.45	30	.48
60 and over.......	109	.68	38	.87
All............	356	.47	103	.61

* Source: Exhibit 3 of report published in 1955 by the Bureau of Accident and Health Underwriters entitled "Combined Personal Accident Experience, Commercial Policies, Policy Years 1948, 1949, 1950, and 1951 Combined."

even though there are only 49 deaths in the latter group. A ratio of 100% is high for female lives.

The upward trend in the claim ratios as the size of policy increases is corroborated by the experience under Personal Accident insurance. Data on male lives published by the Bureau of Accident and Health Underwriters covering the period between 1948 and 1952 policy anniversaries are presented in Table 12. Comparison of the death rates for principal sums under $10,000 and principal sums of $10,000 and over reveals excesses for the larger policies even greater than those observed in the present double indemnity investigation.

The deaths entering into Table 11 were analyzed by cause in relation to

the deaths by cause that might have been expected on the basis of the ratios of Table 5 applied to the expected claims of each of the four age groups separately. Table 13 gives for male lives the ratios of actual claims to such expected claims for separate causes of death and two policy size groups. This table has been confined to male lives because the paucity of deaths among women in the higher amount groups made subdivisions by cause difficult to interpret. The $5,000 to $19,999 category has been com-

TABLE 13

ANALYSIS BY POLICY SIZE GROUP AND CAUSE OF DEATH

MALE EXPERIENCE OF 8 COMPANIES, ALL YEARS OF ISSUE
AND ALL AGES COMBINED

Ratios Expressed Relative to Graduated 1951–56 Rates in Table 3

Expected Claims Distributed in Proportion to Data in Table 5

CAUSE OF DEATH	NUMBER OF CLAIMS (POLICIES)		MORTALITY RATIOS			
	Less than $5,000	$5,000 and Over	Less than $5,000		$5,000 and Over	
			By Number of Policies	By Amount	By Number of Policies	By Amount
Motor Vehicle Accidents...	1,238	837	118%	114%	133%	129%
Accidental Falls..........	125	60	99	85	81	60
Aircraft Accidents........	87	79	98	94	147	164
Accidents Caused by Firearms.................	96	64	145	131	159	130
Accidental Drowning and Submersion.............	89	69	94	93	121	104
Water Transport Accidents.	89	37	152	149	(105)	(118)
Accidents Caused by Fire, Explosion, etc..........	71	33	116	110	(90)	(90)
Homicides................	72	28	123	100	(79)	(84)
All Other Claims.........	280	177	112	109	117	115
All...................	2,147	1,384	116%	110%	124%	120%

NOTE.—Ratios are shown in parentheses where based on 10 to 49 claims.

bined with the $20,000 and over group for this analysis. All ages were combined because there were few causes with as many as 50 deaths when the analysis was made in the broad age groups of Table 11.

Table 13 reveals that for the $5,000 and over group aircraft accidents produced a very high ratio, and that accidents caused by firearms and by motor vehicles also contributed to the high mortality in a significant way. Accidents caused by firearms also produced a high ratio in the under $5,000 group, as did water transport accidents.

Company Variations

Early in the investigation, it was evident from an examination of crude over-all ratios in relation to the 1926–1933 Table that there was considerable variation among the individual contributors in the level of claim rates experienced. Correspondence was conducted with companies which appeared to be out of line without a plausible explanation, such as

TABLE 14

ANALYSIS BY COMPANY

ALL YEARS OF ISSUE AND POLICY DURATIONS COMBINED

RATIOS EXPRESSED RELATIVE TO GRADUATED 1951–56
RATES IN TABLE 3

COMPANY	NUMBER OF CLAIMS (POLICIES)	MORTALITY RATIO	
		By Number of Policies	By Amount
A...............	50	75±7%	50%
B...............	453	75±2	84
C...............	176	88±4	85
D...............	4,265	82±1	91
E...............	3,727	*	94
F...............	224	*	99
G...............	1,501	99±2	101
H...............	201	113±5	102
I...............	1,249	104±2	107
J...............	80	104±8	108
K...............	3,388	107±1	113
L...............	93	114±8	117
M...............	132	124±7	118
N...............	205	108±5	121
O...............	309	115±4	128
P...............	208	112±5	130
Q...............	87	131±9	169
All..........	16,348	....	100%
All, excluding E and F....	12,397	95±1%	101%

* Exposure by policies not submitted.

small volume of data or the territory in which they operated. Some errors in the contributions were found in this way, but in other instances the original contributions were substantiated after further checks were made.

Table 14 lists the companies in ascending order of ratios of actual deaths by amount to the expected based on the graduated 1951–56 claim rates of Table 3. For the companies that contributed policy data, ratios based on policies are also given, along with the probable deviation of such

ratios, which was computed by the formula that has been used for the medical impairment investigations, namely, $\pm \frac{2}{3}MR/\sqrt{\theta'}$, where MR is the mortality ratio and θ' is the number of policies terminated by death. Assuming a normal distribution, the chances are theoretically even that an observed mortality ratio will fall within the range covered by the plus and minus probable deviation from the true value.

The amount ratios, ranging from 50% to 169%, have a greater spread than the policy ratios, which are not as subject to statistical fluctuations. The policy ratios are seen to range from 75% to 131%. It may be significant that the two companies with the highest policy ratios do much of their business in farm states. Population data indicate that the accidental death rate is higher in rural areas than in urban.

The two companies with the lowest policy ratios were asked whether they could think of an explanation for their more favorable experience. Company A suggested as a possibility that it wrote a larger proportion of its business on white collar workers than did other companies. Company B advanced several possibilities: conservative claim practices, stricter underwriting standards some years ago, perhaps a smaller proportion of higher amount policies and a larger proportion of policies on the lives of women.

Differing distributions of business by size of policy and sex are probably an important reason for the variation in the level of mortality ratios from company to company. The general class of business written must also be a factor. The cause of death experience of several of the large companies was examined, and while no clear pattern of differences from company to company was apparent, it was seen that three large companies which write both ordinary and industrial insurance had a better than average experience with respect to motor vehicle accidents, while the three largest companies which did not write industrial insurance had moderately high ratios for this cause of death. When it came to aircraft accidents the distinction was more marked. The "Combination" companies were low in their ratios for this cause of death while the "Ordinary" companies were definitely high.

Whatever the reasons for the company variations, it is evident that the graduated 1951–56 claim rates of Table 3 are not adequate to cover the actual deaths of most of the companies which contributed to the present investigation. Eleven of the 17 contributors had amount ratios of over 100%, four of them being over 120% and three between 110% and 120%. Some of the variance is due to limited volume of data, as may be inferred from the fact that the more extreme departures from 100% are generally associated with larger probable deviations.

COMPARISON WITH POPULATION DATA

Table 15 has been prepared because a comparison of insurance company experience with population data was considered to be of interest. Only the data that ten companies were able to submit with the exposed to risk subdivided by sex was used, since it was evident from a preliminary analysis that the relationship was quite different for female lives than for

TABLE 15

COMPARISON OF INSURANCE COMPANY ACCIDENTAL DEATH EXPERIENCE WITH POPULATION EXPERIENCE

INSURANCE COMPANY RATES BASED ON AGGREGATE DATA BY POLICIES OF 10 COMPANIES

	MALES			FEMALES		
	Rates per 1,000		Ratio, Insurance to Population Data	Rates per 1,000		Ratio, Insurance to Population Data
ATTAINED AGES	Insurance Data 1951-56	U.S. White Population 1952-55*		Insurance Data 1951-56	U.S. White Population 1952-55*	
15-19	.737	.882	84%	.149	.228	65%
20-24	.664	1.213	55	.124	.194	64
25-29	.359	.869	41	.098	.158	62
30-34	.305	.738	41	.088	.151	58
35-39	.296	.719	41	.101	.173	58
40-44	.298	.745	40	.134	.188	71
45-49	.362	.797	45	.182	.211	86
50-54	.383	.873	44	.202	.252	80
55-59	.408	.933	44	.252	.289	87
60-64	.455	1.110	41	.369	.372	99
65-69	.735	1.338	55	.354	.556	64
70-74	1.015	1.660	61	.898	.950	95
75-79	1.751	2.583	68	. . . .	. . . .	. . . .
80-84	4.297	4.022	107	. . . .	. . . .	. . . .

* These rates reflect all accidental deaths coded E800 to E965 and E980 to E985, Sixth Revision, International List. Suicides are not included. The rates are based on numbers of deaths as given in *Vital Statistics—Special Reports, National Summaries*, published by U.S. Department of Health, Education, and Welfare and estimates of the population from *Current Population Reports, Population Estimates*, Series P-25, No. 146, published by U.S. Department of Commerce.

male lives. Claim rates by number of policies were derived from the data for males and females separately and were compared with the corresponding death rates during 1952 to 1955 of white lives in the United States population.

For male lives the insurance claim rates are less than 50% of the population accidental death rates over the important age range from 25 to 64. The explanation no doubt lies in a difference in the classes of lives included in the respective sets of data. The population figures must, for ex-

ample, include proportionately more individuals subject to industrial accident hazards than do the standard Ordinary insurance data.

In the case of women, the insurance claim rates are much closer to the population experience. This should perhaps not be surprising as industrial hazards do not play the same role here. Even though different socio-economic classes of lives may be included in the respective analyses, the variation among such classes in the accidental death rates for women cannot be as great as for men.

It may also be of interest to note that the ratios shown for males in Table 15 at ages 20–49 are very similar to the ratios at these ages appearing for male and female lives combined in Table H of the *TASA* XXXV report. This would seem to indicate that the insurance companies have experienced the same degree of improvement in their accidental death claim rates as has taken place in the population accidental death rates.

EXCLUSIONS FROM COVERAGE

In order to acquire some knowledge of the nature of the exclusions from coverage being administered by the companies contributing to the study, they were asked to furnish information about the types of exclusions appearing in their clauses in the years 1935, 1940, 1946 and 1955 which were actually being enforced in their claims administration during the observation period of this study. Table 16 summarizes the replies received from the companies, the exclusions being listed generally according to the frequency with which they appear in the clauses used in 1955 by 16 of the contributing companies.

All of the companies presently provide coverage on fare-paying aircraft passengers, whereas four of the contributing companies had not provided this coverage on their 1935 and 1940 issues. Causes of accidental death that have been excluded from coverage to an increasing extent over the past twenty years include those due to medical treatment or surgery and to drugs. On 1935 issues only one company excluded death due to medical treatment or surgery and none excluded drugs; on 1955 issues the corresponding numbers with such exclusions were 7 and 6 respectively. The number of companies excluding deaths due to submarine activities has declined from 9 for 1935 issues to 6 for 1955 issues. For all other causes included in the illustrative list in Table 16, there has been no significant change in the degree of usage by the companies over the twenty year period.

A supplementary questionnaire was sent to the companies to elicit more detailed information about their treatment of accidental deaths among persons in military service. It was found that all of the contributing companies excluded service-connected deaths when due to enemy

action. As to service-connected deaths not directly due to enemy action, 12 of the 17 companies excluded coverage when the death was in the Korean area and 9 did so when it was not in the Korean area. Accidental deaths which were not service-connected were excluded by only one company in the Korean area and by none outside of Korea.

Another area that required supplementation had to do with the exclusion of coverage with respect to nonfare-paying passenger aviation deaths.

TABLE 16

SUMMARY OF EXCLUSIONS FROM DOUBLE INDEMNITY COVERAGE
APPLICABLE DURING THE 1951–1956 OBSERVATION PERIOD
FOR 16 OF THE CONTRIBUTING COMPANIES*

EXCLUSION	NUMBER OF COMPANIES APPLYING SPECIFIED EXCLUSION DURING PERIOD OF STUDY			
	Issue Year of Policy			
	1935	1940	1946	1955
Self-destruction.................	16	16	16	16
Illness or disease...............	15	15	15	15
Committing assault or felony....	14	15	15	14
Inhaling gas or fumes..........	13	14	14	13
Air travel, except as fare-paying passenger....................	12	12	14	16
Air travel, even as fare-paying passenger...................	4	4	2	0
Insurrection..................	8	10	10	10
Riot........................	8	10	10	8
Submarine activities...........	9	8	8	6
Medical treatment or surgery....	1	5	6	7
Drugs.......................	0	2	5	6
Sedatives and narcotics........	0	0	1	1
Police duty..................	2	2	1	0
Homicide....................	1	1	0	0
Asphyxiation.................	0	0	0	0
Heat or sun-stroke............	0	0	0	0

* The company omitted from this table did not submit data for years of issue prior to 1946.

The original questionnaire did not bring this information out sufficiently well. Reference to the 1958 edition of *The Handy Guide* disclosed that of the 17 contributors to the study, seven currently grant coverage to nonfare-paying passengers without restriction, three do so except on military planes, three have a restriction with respect to military personnel on military planes, and two have exceptions that would exclude passengers on private or military planes. Only two exclude nonfare-paying passengers entirely. It is evident that the trend has been toward extending coverage to aircraft passengers beyond the fare-paying group.

APPENDIX A
DESCRIPTION OF GRADUATION PROCESS

1951–56 Aggregate Accidental Death Claim Rates

The table of graduated 1951–56 accidental death claim rates was produced to facilitate the analysis of the various subdivisions of the study. The 1926–33 Table was not suitable for this purpose because the improvement in accidental death claim rates since the period covered by that table varies so markedly with age.

As indicated in the report, the new table is based on the total contribution by amounts to all sections of the study to the extent that the crude rates were significant. Thus, aggregate data for both sexes and all policy durations were used. The material submitted by five companies on their lifetime coverage benefits issued before 1935 was combined with the data for the later years of issue of all companies, since the crude rates indicated a similar level of experience by attained age for these two issue year groups. These crude data, together with the final graduated rates as extended to include all ages 1 through 100, are set forth in Table 17.

The first phase of the graduation process was the development of graduated values for each attained age 20 through 82 by application of the Whittaker-Henderson third difference A formula with $a = 3$. The formula was not applied at ages below 20, to avoid flattening out the hump in the accidental death rates that occurs around age 18, nor was it applied at ages over 82, since each of these ages involved less than 25 claims.

A graphic technique was then employed to produce rates for ages 1 to 38, and the Whittaker-Henderson values at ages 20 through 38 were replaced by the graphic values because of the somewhat better fit of the latter rates to the observed experience. For ages 14 through 38 the graphic graduation was developed with reference to the crude values. Since there were fewer than 25 deaths at each age below 14, the graphic graduation for these ages was developed with reference to percentages of population accidental death rates for white lives for the years 1952 through 1955. The percentages were designed to represent the ratio of insurance company to population accidental death rates and were based on examination of the computed ratios for ages 15 and over. The percentages used were 100% for ages 1 to 4, 95% for ages 5 to 9, and 85% for ages 10 to 14. The population accidental death rates used in this operation were determined by combining the rates for male and female lives on a basis which re-

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TABLE 17

SUMMARY OF TOTAL CONTRIBUTION TO STUDY AS USED IN DEVELOPMENT OF GRADUATED 1951–56 ACCIDENTAL DEATH CLAIM RATES

ATTAINED AGE	NUMBER OF CLAIMS	AMOUNT OF CLAIMS PAID	CLAIM RATES PER 1,000 Crude	Grad.	ATTAINED AGE	NUMBER OF CLAIMS	AMOUNT OF CLAIMS PAID	CLAIM RATES PER 1,000 Crude	Grad.
1	0	$ 0	*	.424	51	290	$938,334	.353	.362
2	0	0	*	.347	52	283	881,753	.358	.367
3	0	0	*	.298	53	308	873,835	.380	.374
4	0	0	*	.264	54	255	839,546	.390	.383
5	1	1,000	*	.239	55	218	703,423	.347	.395
6	5	25,050	*	.220	56	275	742,131	.400	.409
7	7	8,000	*	.207	57	254	742,938	.434	.425
8	6	10,000	*	.202	58	231	784,122	.501	.442
9	6	14,000	*	.198	59	231	765,190	.535	.460
10	8	8,000	*	.203	60	190	575,604	.459	.480
11	13	14,500	.096	.212	61	163	448,400	.396	.502
12	16	19,016	.101	.230	62	173	527,741	.515	.528
13	18	18,000	.081	.260	63	179	493,744	.532	.557
14	41	55,716	.217	.301	64	173	505,749	.613	.589
15	60	121,945	.352	.366	65	131	472,060	.737	.622
16	128	279,119	.586	.490	66	104	264,466	.456	.656
17	137	309,130	.486	.556	67	133	433,867	.833	.692
18	247	588,187	.614	.578	68	126	378,372	.819	.730
19	298	728,782	.594	.583	69	81	244,572	.596	.771
20	324	761,823	.525	.575	70	112	352,578	.996	.819
21	355	833,914	.512	.554	71	84	235,861	.782	.878
22	382	1,006,804	.553	.519	72	84	292,821	1.141	.952
23	368	1,116,202	.539	.471	73	64	175,673	.809	1.046
24	336	966,748	.416	.420	74	84	222,017	1.223	1.166
25	311	926,352	.360	.377	75	56	145,424	.957	1.315
26	276	858,267	.305	.345	76	70	248,326	1.999	1.494
27	287	942,233	.310	.324	77	67	193,224	1.926	1.703
28	276	913,710	.283	.309	78	51	133,088	1.706	1.943
29	290	925,669	.271	.300	79	41	71,680	1.200	2.216
30	311	1,104,954	.304	.294	80	39	151,265	3.432	2.521
31	365	1,309,318	.346	.290	81	33	97,629	3.127	2.852
32	333	1,178,781	.304	.287	82	33	61,573	2.891	3.206
33	343	1,245,890	.312	.286	83	15	41,357	2.853	3.584
34	333	1,149,656	.281	.286	84	13	17,500	1.851	3.988
35	313	880,084	.213	.286	85	11	18,500	3.187	4.419
36	395	1,379,359	.330	.287	86	9	25,825	*	4.878
37	372	1,269,850	.297	.289	87	0	0	*	5.367
38	360	1,372,399	.321	.291	88	1	1,000	*	5.886
39	376	1,081,467	.253	.293	89	0	0	*	6.437
40	373	1,338,383	.314	.295	90	0	0	*	7.022
41	393	1,409,164	.337	.299	91	0	0	*	7.642
42	316	945,564	.232	.305	92	0	0	*	8.298
43	362	1,226,505	.309	.313	93	0	0	*	8.991
44	404	1,233,252	.319	.322	94	0	0	*	9.723
45	407	1,257,770	.337	.331	95	0	0	*	10.495
46	377	1,308,756	.366	.339	96	0	0	*	11.308
47	363	1,250,835	.366	.346	97	0	0	*	12.164
48	339	1,091,762	.338	.351	98	0	0	*	13.064
49	317	1,106,662	.365	.355	99	0	0	*	14.009
50	335	1,005,482	.354	.358	100	0	0	*	15.000

* Rates not shown where the number of claims is less than 10.

flected the composition of insurance data by sex. Further, one-half of the homicides and all the suicides were excluded from the population rates so that those rates would be more consistent with insurance company data as shown in Table 5.

The graduated values were extended to age 100 by fitting a third degree curve to the graduated rates at ages 80, 81 and 82 and a rate of 15 per thousand at age 100. The latter rate was arrived at by inspection of population accidental death rates for the years 1952 through 1955.

Table 18 contains a comparison of the actual and tabular claims in five

TABLE 18

TEST OF GRADUATION
1951–56 AGGREGATE ACCIDENTAL DEATH CLAIM RATES

Attained Age Group	Actual Claims	Tabular Claims	Actual minus Tabular Claims	Ratio of Actual to Tabular Claims
1–4	$ 0	$ 1,168	−$ 1,168	. . . .
5–9	58,050	52,280	5,770	111.0%
10–14	115,232	232,546	− 117,314	49.6
15–19	2,027,163	1,982,423	44,740	102.3
20–24	4,685,491	4,633,616	51,875	101.1
25–29	4,566,231	4,948,120	− 381,889	92.3
30–34	5,988,599	5,588,819	399,780	107.2
35–39	5,983,159	6,111,539	− 128,380	97.9
40–44	6,152,868	6,235,626	− 82,758	98.7
45–49	6,015,785	5,840,518	175,267	103.0
50–54	4,538,950	4,567,966	− 29,016	99.4
55–59	3,737,804	3,636,578	101,226	102.8
60–64	2,551,238	2,713,002	− 161,764	94.0
65–69	1,793,337	1,792,742	595	100.0
70–74	1,278,950	1,238,006	40,944	103.3
75–79	791,742	840,245	− 48,503	94.2
80–84	369,324	358,113	11,211	103.1
85–89	45,325	59,521	− 14,196	76.1
90–94	0	1,598	− 1,598	. . . .
95–100	0	89	− 89	. . . .
All	$50,699,248	$50,834,515	−$135,267	99.7%
To 24	$ 6,885,936	$ 6,902,033	−$ 16,097	99.8%
25–34	10,554,830	10,536,939	17,891	100.2
35–44	12,136,027	12,347,165	− 211,138	98.3
45–54	10,554,735	10,408,484	146,251	101.4
55–64	6,289,042	6,349,580	− 60,538	99.0
65 and over	4,278,678	4,290,314	− 11,636	99.7
All	$50,699,248	$50,834,515	−$135,267	99.7%

year and in broader age groups. It may be noted that where the data are significant the greatest departure of the graduated values from the crude values occurs in the age groups 25–29 and 30–34, the graduated values going above the crude values in the first group and below in the second. A better fit for each of these age groups would have resulted in a wave in the mortality rates in the age range 25 to 40. There would have been a dip in the 25–29 group, a slight rise in the 30–34 group, another dip in the 35–39 group, followed by continuous increases to the end of the table. Since this wave pattern does not appear in population data nor in the contributions of several of the contributing companies, it was decided to depart from the crude data to the extent indicated.

1951–56 Male Accidental Death Claim Rates

For companies desiring to analyze their experience on male lives separately, a table representing male accidental death rates consistent with the 1951–56 aggregate accidental death claim rates in Table 3 was prepared. A female table can be approximated by applying to the male table the ratios shown in Table 8, or appropriate modifications thereof.

Ratios of the crude male claim rates by amount of insurance to combined claim rates for both sexes were computed based on the data of the ten companies submitting a breakdown by sex. These ratios for ages 15 through 65 were graduated by the Whittaker-Henderson third difference A formula with $a = 3$. The resulting ratios graded down from 118.6% at age 15 to 102.7% at ages 50 and 51, increased to 103.7% for ages 56–58, then graded down to 101.9% for ages 64 and 65.

These graduated ratios were extended graphically to a value of 110.0% for age 1, such ratio being established by reference to population data, taking account of insurance data male proportions and the relative male-female population accident rates. For age 66 to age 84 the ratios were extended linearly to a value of 100% for age 84. A 100% ratio was also used for ages 85 through 100, where the exposure would be almost entirely on male lives.

The graduated ratios were then applied to the 1951–56 aggregate accidental death claim rates, which were based on the experience of all 17 companies, to arrive at the male table. In the absence of male data for all 17 companies and with a different level of mortality prevailing for the ten companies which submitted separate male and female data, none of the standard tests of fit of the resulting male accidental death rates were appropriate. The ratios used, however, represented a close fit to the data of the ten companies which had subdivided their data by sex.

SPECIFICATIONS OF 1957 INTERCOMPANY
DOUBLE INDEMNITY STUDY

(As transmitted with letter of March 11, 1957)

Purpose

To study the accidental death rate under double indemnity provisions issued by life insurance companies as a part of Ordinary insurance policies in the United States and Canada. It is probable that a new table of double indemnity mortality rates will be developed.

Scope of Investigation

Issue Years: 1935 to 1940 and 1946 to 1955. Companies with lifetime coverage clauses issued in earlier years are also asked to contribute data on those clauses.

Observation Period: 1951 to 1956 policy anniversaries.

The investigation will in general be confined to standard double indemnity clauses. However, those companies which cannot separate standard from substandard clauses should nevertheless contribute their data if the claims on substandard clauses do not exceed 5% of the total claims.

Clauses automatically incorporated in life insurance policies are to be excluded from the investigation.

The data for policy years 1, 2 and 3 are to be studied separately by age at issue, and the data for later durations are to be combined by attained age.

Riders added after the issuance of a policy may be included, but it is not necessary to do so. Determination of the proper policy duration may be a problem. To the extent practical, the duration should be counted from the time of addition. It is recognized that some companies will not be able to differentiate such clauses from those included in policies at the time of original issue, in which case duration would, of course, be measured from original issue.

The experience will be investigated by amount of insurance and, in so far as the data are available on that basis, by number of policies also.

Sampling methods may be used in the derivation of a company's contribution. The contribution itself should be the equivalent of 100% of the data.

Care should be taken to omit exposures after the limiting age for the benefit.

Special Subdivisions of Material

To the extent that the records of the companies make such sub-divisions possible, the data are to be studied according to
1. The sex of the insured
2. The size of the policy
   a) Less than $5,000
   b) $5,000 to $19,999
   c) $20,000 and over

The policy size at time of issue is preferred. The amount classification for exposures and claims should in any event be consistent.

Causes of Accidental Death

An analysis of causes of death will be made, using the code sub-divisions listed in Enclosure D [reproduced on p. 78].

Pending, Resisted and Unreported Claims

The date of death, rather than the date of payment, should determine whether a claim is to be included in the experience and whether it is to be assigned to the first, second, third, or later policy years.

Claims that are being resisted at the time of the compilation of the data should be reviewed for the purpose of determining the proper share of them that should be included in the investigation as though they were approved claims.

Claims approved after the close of the observation period should be reviewed to as late a date as possible prior to the submission of a company's data, for the selection of the cases that properly belong in the investigation.

If a company's past experience suggests that the above procedure will result in the omission of a significant number of cases, the company should indicate what percentage adjustment of its claims over the five year observation period is required to offset the omission.

Method of Transmitting Data

1. Summary punch cards for exposed to risk and claims paid, by indi-vidual issue ages for policy years 1, 2 and 3 separately, and by indi-vidual attained ages for policy years 4 and later combined. (Separate instructions are given for companies whose data are available only in five year issue age groups.)
2. Individual punch cards for the claims, including information regarding the causes of death.

CAUSE OF DEATH CODES FOR 1957

INTERCOMPANY DOUBLE INDEMNITY INVESTIGATION

Code	Title	6th Revision International List Codes	1950 Intercompany Cause Code
01	Motor Vehicle Accidents	E810–835	88
02	Aircraft Accidents	E860–866	89
03	Accidental Poisoning by Solid and Liquid Substances	E870–888	Part of 90
04	Accidental Poisoning by Gases and Vapors	E890–895	Part of 90
05	Accidental Falls	E900–904	91
06	Accident Caused by Machinery	E912	92
07	Accident Caused by Fire, Explosion, etc.	E916–918	93
08	Accident Caused by Firearm	E919	94
09	Accidental Drowning & Submersion (excluding water transport accidents)	E929	95
10	Water Transport Accidents	E850–858	Part of 96
11	Accident Caused by Electric Current	E914	Part of 96
12	Blow from Falling Object	E910	Part of 96
13	Suffocation	E921–922 E924–925	Part of 96
14	Suicide	E970–979	97
15	Homicide	E980–985	98
16	All other claims	Residual	