

ACTUARIAL NOTE: MORTALITY EXPERIENCE OF
BANKERS LIFE INSURANCE COMPANY
OF NEBRASKA 1945-1950

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MORTALITY results are always of interest to the actuary, no matter what particular segment of population is studied. This note is presented primarily because of the dearth of reports from the smaller companies, most of whom have similar problems and clientele to the Bankers, in the hope that more discussions and more results will be published in this area. For convenience the note is divided into sections entitled: Objectives, Substandard, Expected Mortality, General, War Deaths, Medical, Nonmedical, Juvenile, Selection, Dividends, and Summary.

OBJECTIVES

Our first objective is to furnish management with the facts of our experience. This includes a comparison between medical and nonmedical business and the maintaining of a continuous investigation procedure. Our second objective is to determine experience rates of mortality for dividend purposes.

SUBSTANDARD

As we have been active in the substandard field for a comparatively short time, we did not find it feasible to attempt an elaborate investigation at this time. This note is therefore concerned only with standard business.

EXPECTED MORTALITY

We used as our standard of expected mortality the 1946-1949 Select and Ultimate Basic Table (*TSA* II, 505). As the table is not shown for ages below 10 on the select basis and 25 on the ultimate basis, it was necessary to graft an extension to the Ultimate Table for these ages. We used, in effect, a rough graphic graduation of the results in *TASA* XLIII blending into age group 10-14 in insurance year eight; the final figures are shown in Appendix A. We also show our results in terms of the American Experience and CSO Tables. The comparison of results on the three bases should be of special interest to the actuary. There is a striking example of the redundancy of the older tables in the nonmedical section.

GENERAL

All standard issues are exposed from the anniversaries in 1945 to the anniversaries in 1950. Each policy year is done separately so that any pe-

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riod of observation may be used in the future. This year we will obtain the results for the 1950 to 1951 policy year. Five-year age groups at issue are used except that 0, 1, 2, 3, and 4 are done separately. A table of exposed to risk, actual deaths and ratios of actual to expected mortality is shown below.

	EXPOSED TO RISK		ACTUAL DEATHS		ACTUAL TO EXPECTED MORTALITY BY 1946-49 SELECT AND ULTIMATE BASIC TABLE	
	No.	Amount	No.	Amount	No.	Amount
Medical.	346,125	683,975,227	2,268	4,584,096	75.5%	81.0%
With War Deaths Excluded			2,240	4,546,418	74.5	80.3
Nonmedical.	142,752	232,623,495	165	261,011	101.5	100.0
With War Deaths Excluded			157	253,641	96.6	97.2
Total.	488,877	916,598,722	2,433	4,845,107	76.8%	81.8%
With War Deaths Excluded			2,397	4,800,059	75.7	81.1

Table I shows the detailed results by age group and duration using the 1946-1949 Select and Ultimate Basic Table as the expected standard. Table II is a comparison of results on American Experience, CSO and the 1946-49 Basic Table. Table III shows the breakdown of deaths by cause. Appendix B is the aggregate table proposed for use in dividend apportionment.

WAR DEATHS

War deaths consisted of 36 policies for \$45,048, issued at ages 10 through 29, and amounted to .76% of the total expected. These were largely concentrated in the policy year 1945-46. For age group 10-14 at issue, medical, the actual to expected ratio dropped from 133% to 73% with war deaths excluded. Charts I and II show the effect of war deaths for medical and nonmedical business. In Table I figures excluding war deaths are shown in parentheses.

MEDICAL

The oldest policy in the experience was issued in 1888. The actual to expected ratios by age group at issue did not vary substantially from the over-all averages except for 10-14 and 55-59. As explained in the previous paragraph, war deaths accounted for the extra mortality in age group 10-14. In examining age group 55-59, it was found that 5 lives accounted for 35% of the amount paid on death. Weighting these lives by the aver-

age amount for the group the actual to expected ratio goes from 126.9% to 86.2%. It is extremely interesting to note the comparison of actual to expected ratios by the three standards. Our more mature medical experience runs 40% by American Experience, 50% by CSO and 81% by the 1946-1949 Select and Ultimate Basic Table. Chart III illustrates this difference by comparing expected mortality under the three standards with the actual mortality.

NONMEDICAL

Nonmedical business has been issued since 1940 in the Bankers with a maximum amount of \$5,000 and for ages 0-40. A comparison with medical business for the corresponding issues and ages is shown below with war deaths excluded.

AGE	MEDICAL		NONMEDICAL	
	Number of Deaths	Actual to Expected	Number of Deaths	Actual to Expected
0.....	2	35.9%	18	41.2%
1.....	1	60.1	5	51.1
2.....	0	0.0	3	81.5
3.....	0	0.0	0	0.0
4.....	0	0.0	2	119.0
5-9.....	4	137.7	8	105.5
10-14.....	6	109.2	7	98.1
15-19.....	9	68.3	20	93.0
20-24.....	12	58.8	22	110.6
25-29.....	25	145.1	20	118.0
30-34.....	14	78.5	24	158.3
35-39.....	32	92.3	22	113.7
40-44.....	58	114.5	6	75.4
Total.....	163	99.8%	157	97.2%
0-39.....	105	91.1	151	100.9

Chart IV shows the comparison. The difference in expected mortality by the Basic table, American Experience, and CSO to the actual is illustrated in Chart V. This experience, concentrated at the younger ages and in the select years illustrates strikingly how misleading mortality ratios by the older tables can be.

Table III shows the causes of death, medical and nonmedical. It is interesting to note that although the accidental death rate is approximately the same, the percentage of accidental deaths is 42% of the total for non-medical and only 7% for medical because of the concentration of non-medical exposure at the younger ages and low durations.

TABLE I

DEATHS BY POLICIES AND RATIOS OF ACTUAL TO EXPECTED BY AMOUNTS
ANNIVERSARIES IN 1945 TO ANNIVERSARIES IN 1950
EXPECTED BY 1946-49 SELECT AND ULTIMATE BASIC TABLE

DURATIONS	AGE 0		AGES 1-9		AGES 10-19		AGES 20-29		AGES 30-39		AGES 40-49		AGES 50-59		AGES 60 AND OVER		ALL AGES	
	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E
	Medical																	
1.....	0	*	0	*	3	*	4	*	0	*	4	*	1	*	0	*	12	55
2.....	0	*	1	*	0	*	4	*	9	*	4	*	4	*	2	*	24(23)	141(139)
3.....	0	*	0	*	0	*	3	*	1	*	13	*	3	*	2	*	22	104
4.....	0	*	1	*	0	*	3	*	5	*	9	*	1	*	2	*	21	83
5.....	0	*	0	*	3	*	4	*	2	*	14	*	6	*	2	*	31(30)	139(138)
6-10.....	2	*	3	*	22	*	24	*	29	82%	78	92%	52	151%	6	*	216(200)	103(98)
11-20.....	0	*	1	*	34	80%	69	88%	131	73	191	66	148	74	22	*	596(587)	73(72)
21-30.....	0	*	0	*	35	81	145	80	221	72	206	76	87	110	7	*	701(700)	79(79)
31 and over.....	0	*	0	*	24	*	245	69	278	84	80	86	18	*	0	*	645	79
All.....	2	35%	6	75%	121 (100)	88% (73)	501 (494)	79% (78)	676	77%	599	78%	320	95%	43	83%	2,268 (2,240)	81 (80)
	Nonmedical																	
1.....	8	*	4	*	2	*	13	*	4	*	1	*					32	83
2.....	3	*	4	*	6	*	11	*	7	*	1	*					32(31)	111(111)
3.....	4	*	2	*	6	*	9	*	8	*	1	*					30(28)	108(108)

* Less than 25 deaths.

Note: Figures in parentheses exclude war deaths.

TABLE I—Continued

DURATIONS	AGE 0		AGES 1-9		AGES 10-19		AGES 20-29		AGES 30-39		AGES 40-49		AGES 50-59		AGES 60 AND OVER		ALL AGES	
	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E	No.	A/E
<i>Nonmedical—Continued</i>																		
4.....	1	*	3	*	8	*	4	*	10	*	1	*	.....	.....	.....	.....	27	137
5.....	2	*	3	*	3	*	3	*	7	*	0	*	.....	.....	.....	.....	18(16)	106(98)
6 and over....	0	*	2	*	5	*	7	*	10	*	2	*	.....	.....	.....	.....	26(23)	79(69)
All.....	18	41%	18	73%	30 (27)	99% (94)	47 (42)	124% (116)	46	133%	6	75%	.....	.....	.....	.....	165 (157)	100 (97)
<i>Medical and Nonmedical</i>																		
1.....	8	*	4	*	5	*	17	*	4	*	5	*	1	*	0	*	44	70
2.....	3	*	5	*	6	*	15	*	16	*	5	*	4	*	2	*	56(54)	129(128)
3.....	4	*	2	*	6	*	12	*	9	*	14	*	3	*	2	*	52(50)	105(104)
4.....	1	*	4	*	8	*	7	*	15	*	10	*	1	*	2	*	48	98
5.....	2	*	3	*	6	*	7	*	9	*	14	*	6	*	2	*	49(46)	131(129)
6-10.....	2	*	5	*	27	126%	31	88%	39	84%	80	92%	52	151%	6	*	242(223)	101(96)
11-20.....	0	.....	1	*	34	80	69	88	131	73	191	66	148	74	22	*	596(589)	73(72)
21-30.....	0	.....	0	.....	35	81	145	80	221	72	206	76	87	110	17	*	701(700)	79(79)
31 and over....	0	.....	0	.....	24	*	245	69	278	84	80	86	18	*	0	*	645	79
All.....	20	40%	24	74%	151 (127)	91% (78)	548 (536)	81% (80)	722	79%	605	78%	320	95%	43	83%	2,433 (2,397)	82 (81)

TABLE II
RATIOS OF ACTUAL TO EXPECTED MORTALITY
BY 1946-49 BASIC TABLE, CSO, AMERICAN EXPERIENCE
ANNIVERSARIES IN 1945 TO ANNIVERSARIES IN 1950

	Ages									
	0	1-9	10-19	20-29	30-39	40-49	50-59	60 & over	All	
	<i>Medical</i>	35%	75%	88%	79%	77%	78%	95%	83%	81%
Basic.....	9	24	39	46	50	51	59	48	50	
CSO.....	1	5	20	33	42	47	56	45	40	
A.E.....										
<i>Nonmedical</i>	41%	73%	99%	124%	133%	75%			100%	
Basic.....	10	33	33	33	33	22			28	
CSO.....	1	9	10	13	20	18			8	
A.E.....										
<i>Medical and Nonmedical</i>	40%	74%	91%	81%	79%	78%	95%	83%	82%	
Basic.....	10	30	38	45	48	50	59	48	48	
CSO.....	1	7	16	29	39	46	56	45	33	
A.E.....										
Durations										
	1	2	3	4	5	6-10	11-20	21-30	31 & over	All
<i>Medical</i>	55%	141%	104%	83%	139%	103%	73%	79%	79%	81%
Basic.....	11	39	35	31	58	47	46	57	62	50
CSO.....	6	23	23	21	40	33	38	52	58	40
A.E.....										
<i>Nonmedical</i>	83%	111%	108%	137%	106%	79%				100%
Basic.....	18	31	32	44	37	28				28
CSO.....	4	8	11	16	14	12				8
A.E.....										
<i>Medical and Nonmedical</i>	70%	129%	105%	98%	131%	101%	73%	79%	79%	82%
Basic.....	15	36	34	35	52	45	46	57	62	48
CSO.....	5	14	17	19	30	30	38	52	58	33
A.E.....										
Exposure Year										
	1945-46	1946-47	1947-48	1948-49	1949-50	All				
<i>Medical</i>	102%	76%	72%	86%	73%	81%				
Basic.....	62	46	44	53	46	50				
CSO.....	50	38	36	43	37	40				
A.E.....										
<i>Nonmedical</i>	168%	117%	95%	69%	99%	100%				
Basic.....	47	33	27	20	30	28				
CSO.....	12	9	7	5	8	8				
A.E.....										
<i>Medical and Nonmedical</i>	104%	77%	73%	85%	75%	82%				
Basic.....	61	45	42	49	44	48				
CSO.....	44	32	29	33	29	33				
A.E.....										

TABLE III
DEATHS BY CAUSE
ANNIVERSARIES IN 1945 TO ANNIVERSARIES IN 1950

CAUSE OF DEATH	MEDICAL				NONMEDICAL				MEDICAL AND NONMEDICAL			
	No.	%	Amount	%	No.	%	Amount	%	No.	%	Amount	%
Cancer.....	315	14	\$ 619,981	14	10	6	\$ 10,500	4	325	13	\$ 630,481	13
T.B.....	21	1	34,496	1	0	0	0	0	21	1	34,496	1
Cerebral.....	277	12	549,513	12	5	3	10,000	4	282	12	559,513	12
Coronary.....	706	32	470,142	32	13	8	20,800	8	719	30	1,490,942	30
Other Circ.....	308	14	680,594	15	10	6	17,600	7	318	13	698,194	14
Pneumonia.....	64	3	120,378	3	5	3	4,109	2	69	3	124,487	3
Other Resp.....	60	3	106,876	2	4	2	4,000	2	64	3	110,876	2
Nephritis.....	28	1	52,500	1	5	3	6,500	2	33	1	59,000	1
Motor Vehicle.....	75	3	160,131	3	30	19	59,085	22	105	4	219,216	5
Suicide.....	56	2	145,239	3	7	4	8,799	3	63	3	154,038	3
Other Accidents.....	76	3	171,248	4	33	20	51,748	20	109	4	222,996	5
War.....	28	1	37,678	1	8	5	7,370	3	36	1	45,048	1
All Other.....	254	11	435,420	9	35	21	59,500	23	289	12	494,920	10
Total.....	2,268	100	\$4,584,096	100	165	100	\$261,011	100	2,433	100	\$4,845,107	100

CHART I
ACTUAL TO EXPECTED MORTALITY BY AGE GROUP AT ISSUE
MEDICAL BUSINESS

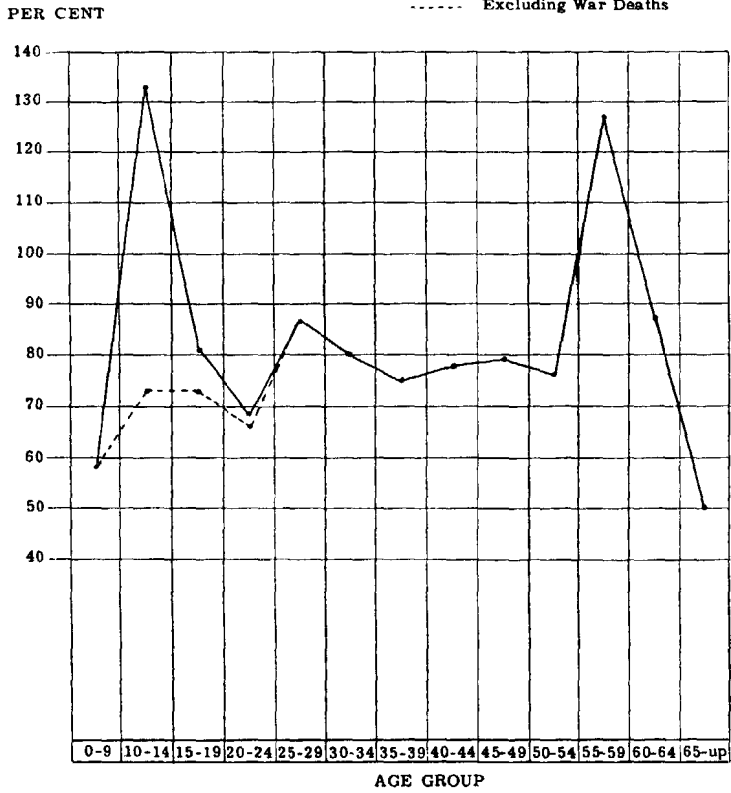


CHART II
ACTUAL TO EXPECTED MORTALITY BY AGE GROUP AT ISSUE
NONMEDICAL BUSINESS

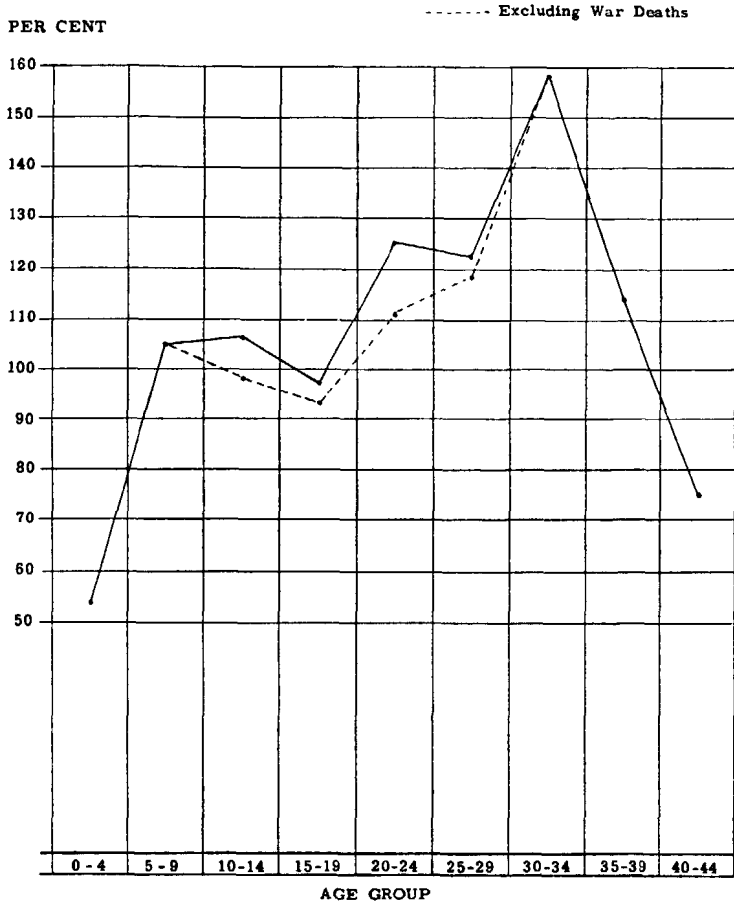


CHART III
EXPECTED MORTALITY BY 1946-1949 SELECT AND ULTIMATE BASIC TABLE, CSO AND
AMERICAN EXPERIENCE DIVIDED BY ACTUAL MORTALITY
MEDICAL BUSINESS

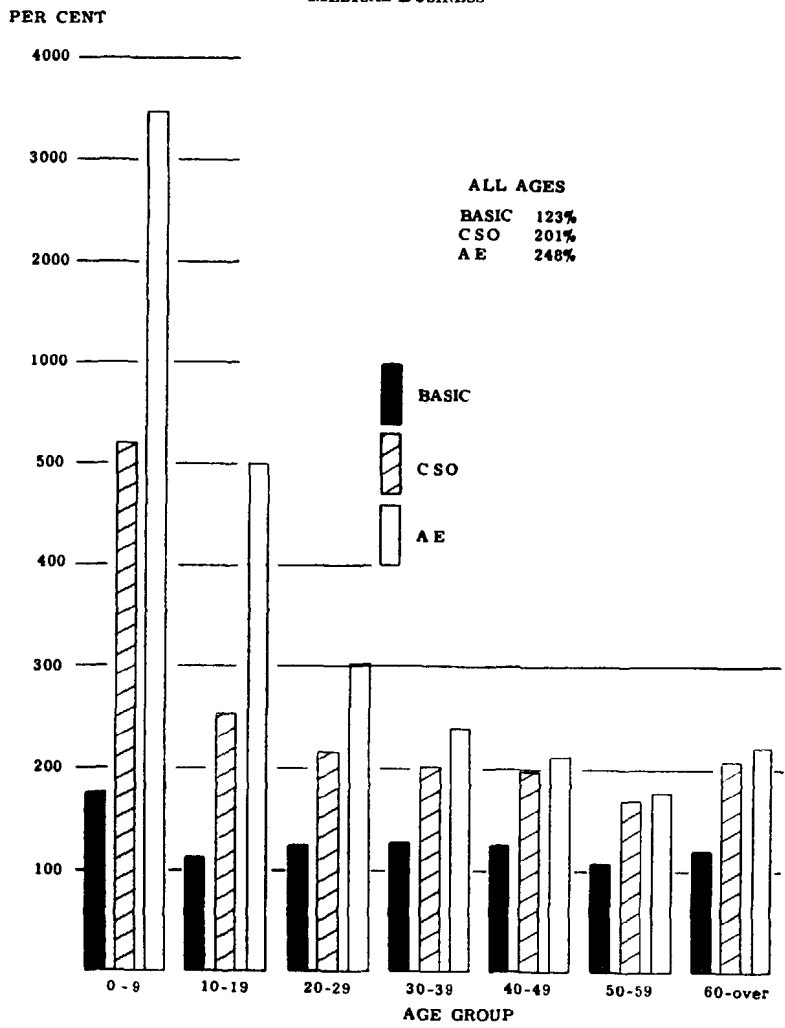


CHART IV

ACTUAL TO EXPECTED MORTALITY BY AGE GROUP AT ISSUE, COMPARISON OF
NONMEDICAL BUSINESS WITH MEDICAL BUSINESS ISSUED 1940 THROUGH 1949
WAR DEATHS EXCLUDED

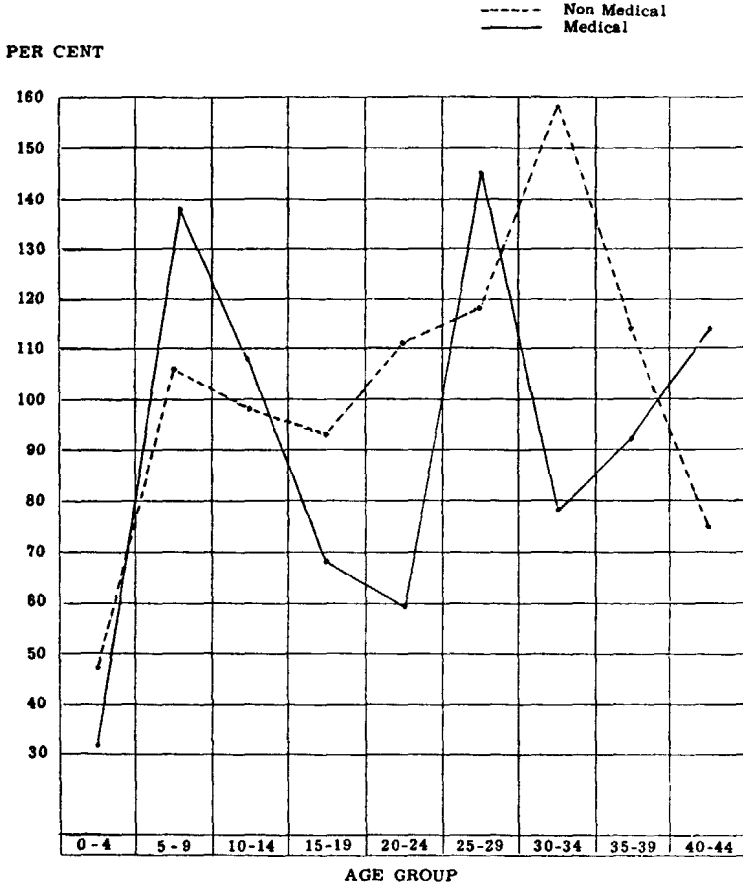


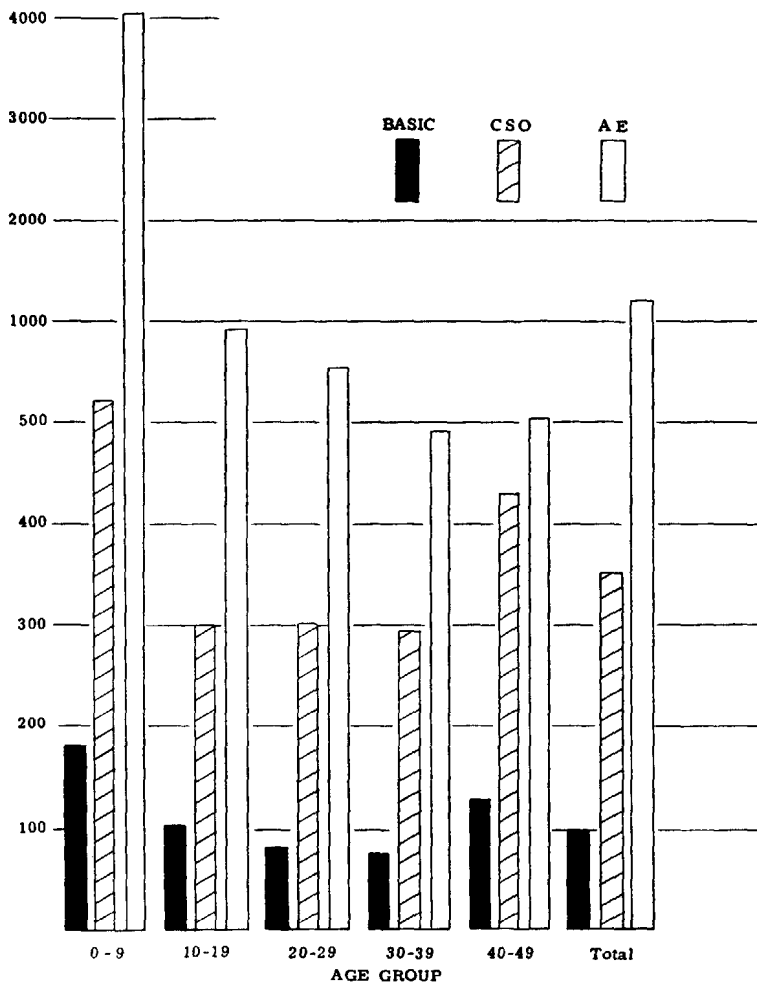
CHART V

EXPECTED MORTALITY BY 1946-1949 SELECT AND ULTIMATE BASIC TABLE CSO AND AMERICAN EXPERIENCE DIVIDED BY ACTUAL MORTALITY

NONMEDICAL BUSINESS

PER CENT

5000 _____



JUVENILE

In common with many companies, we found mortality at the juvenile ages extremely light. The crude rates for age 0, 1, and 2 were .00150, .00042, and .00133. Most of our business is issued on the nonmedical basis with age 0 the largest group. We do not use a minimum age such as six weeks, but will accept applications on children at birth.

SELECTION

We were hampered in trying to measure the effect of selection by the paucity of our data. By grouping in larger age groups and taking ratios to the ultimate table, it appeared that we had a select period of approximately seven years. For our asset share studies, we shall probably use the following ratios of the aggregate table.

Year	Ratio
1	51%
2	63
3	73
4	81
5	87
6	92
7	96

DIVIDENDS

Mortality contribution in our three factor formula is expressed as a percentage of the cost of insurance. For our purposes, it would not be practicable to use a select and ultimate table even if a reasonable table could be derived from the data. We therefore decided to use the aggregate table shown in Appendix B. The table reproduces 100.65% of the actual deaths, by amount, for the entire range of ages. For the future a similar table will be derived on a moving five year basis each year for use in necessary changes in dividend apportionment.

SUMMARY

Our investigation shows an over-all ratio of 81.8% to 1946-1949 Basic with extremely light mortality at the younger ages grading gradually upward at the higher ages at issue. Age group 55-59 shows the heaviest results. Nonmedical and analogous medical show little difference although the data are limited. Cancer, cerebral accidents, coronary artery disease, and other circulatory diseases account for 73% of the deaths in the medical experience while motor vehicle and other accidents account for 42% of the deaths in the nonmedical experience. War deaths were not significant in the over-all experience in amount, but must be considered in un-

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derwriting juvenile business. Our experience illustrates strikingly how misleading averages on the older tables may be in attempting to measure young and immature experiences.

APPENDIX A

COMPARISON OF VARIOUS PUBLISHED TABLES AND FINAL JUVENILE EXTENSION—ULTIMATE 1946-49 BASIC TABLE
1,000_{q_x}

AGE <i>x</i>	JOINT COMMITTEE		WESTERN AND SOUTHERN	LONDON	PRUDENTIAL	METROPOLITAN	SELECT 1946-49 BASIC§	EXTENSION	
	TASA XXXVIII Graduated Rates		*TASA XLIII Issues 1925-40 1940-41 Policies	TASA XLIX Issues 1941-46 to 1947 Policies	TASA XLIX Issues 1940-45 to 1946 Amounts	TASA XLIX Issues 1941-46 to 1947 Amounts			TASA XLIX Issues 1941-45 to 1946 Policies
	Policies	Amounts							
0	11.52	11.14	4.15	6.73	5.26	5.60	3.68	4.68†	
1	5.41	5.75	1.95	1.90‡		2.82	1.64	2.09†	
2	3.51	3.69	1.26			1.34		1.26	
3	2.55	2.74	.92					.92	
4	2.25	2.47	.81					.81	
5	2.02	2.23	.99					.81	
6	1.83	2.01	.90					.81	
7	1.64	1.77	.80					.80	
8	1.46	1.53	.72					.72	
9	1.23	1.28	.60					.61	
10	1.07	1.10	.61					.61	
11	1.00	1.01	.57					.57	
12	1.00	1.00	.57				.40	.57	
13	1.07	1.07	.61				.50	.61	
14	1.19	1.18	.68				.59	.68	
15	1.34	1.33	.76				.65	.76	
16	1.55	1.51	.88				.75	.83	
17	1.77	1.69	1.01				.82	.89	
18	1.96	1.87	1.12				.88	.94	
19	2.16	2.09	1.23				.97	.97	
20							1.02	1.02	
21							1.08	1.08	
22							1.10	1.10	
23							1.12	1.12	
24							1.13	1.13	
25							1.14	1.14	

* 0-4, 36%; 5-9, 49%; 10-19, 57%.

† Crude rate [0] and [1], TASA XLIII.

‡ [1] and [0] + 1 combined.

§ Middle age plus duration minus one.

APPENDIX B
BANKERS LIFE AGGREGATE 1945-50 TABLE

Age	1,000q	Age	1,000q	Age	1,000q	Age	1,000q
0	2.52	24	1.16	48	5.32	72	40.68
1	1.12	25	1.29	49	5.50	73	48.35
2	.68	26	1.39	50	5.65	74	56.32
3	.57	27	1.44	51	5.85	75	64.46
4	.49	28	1.39	52	6.20	76	72.69
5	.46	29	1.30	53	6.70	77	80.90
6	.45	30	1.18	54	7.40	78	89.02
7	.46	31	1.07	55	8.19	79	96.95
8	.48	32	1.02	56	9.25	80	105.45
9	.50	33	1.04	57	10.42	81	115.03
10	.52	34	1.13	58	11.77	82	125.67
11	.58	35	1.24	59	13.32	83	137.20
12	.74	36	1.36	60	14.94	84	149.31
13	.80	37	1.46	61	16.55	85	161.68
14	.86	38	1.50	62	18.07	86	174.20
15	.92	39	1.53	63	19.50	87	186.80
16	.98	40	1.59	64	20.92	88	199.42
17	1.03	41	1.74	65	22.34	89	212.04
18	1.02	42	2.04	66	23.80	90	224.66
19	.99	43	2.53	67	25.36	91	237.28
20	.96	44	3.17	68	26.94	92	249.90
21	.94	45	3.86	69	28.70	93	262.52
22	.96	46	4.50	70	31.05	94	275.14
23	1.04	47	5.00	71	34.37	95	287.76