

**TRANSACTIONS OF SOCIETY OF ACTUARIES  
1997-98 REPORTS**

**REINSURANCE INTERCOMPANY MORTALITY STUDY  
FOR ADVANCED AGE  
(1994 EXPERIENCE)**

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**DESCRIPTION OF THE STUDY**

***Observation Period and Policy Issue Years***

This report covers the experience for calendar year 1994. The earliest issue year for all policies reported by participants was 1971.

***Policies Included in the Study***

Only policies and net amount at risk reinsured to the participants are included in this study. Policies for advanced age are those with an issue age of 70 and over regardless of face amount level, where the residence of the insured at issue is the U.S., and the currency of the policy is in U.S. dollars. Only single life policies are included.

***Exposure Calculation***

The net amount at risk is assumed to be level throughout the exposure period and is either the most current information or the recorded face amount as at the end of 1994, depending on the company's reporting method.

For a policy in force through the study year, two exposure records are created. One reflects the fraction of the year between the prior December 31 and the policy anniversary. The other reflects the fraction of the year between the policy anniversary and December 31 of the study year. Obviously these two fractions sum to one. The difference between the two records is in the policy duration.

For policies withdrawing during the study year, one or two exposure records will be created, depending on whether the withdrawal is after the anniversary or not. The exposure fraction is calculated consistent with the in-force situation. Fractions would not sum to one in this case except for withdrawals occurring on December 31 of the study year.

For death claims, one or two exposure records will be created, depending on whether the death occurs before the anniversary or not. Note the difference in treatment of exact anniversary deaths and withdrawals. The exposure will be one for the record reflecting the period in which the death occurs. Hence, the total exposure will be greater than one for policies with post and

\*Sponsored by the Society of Actuaries Reinsurance Council and Manulife Reinsurance

anniversary deaths.

For policies issued in the study year, one exposure record will be created consistent with the rest of the exposure calculations. Hence, a policy issued on January 1 of the study year will contribute one day less than a full year's exposure to the study, while one issued on December 31 of the study year will be included in the study, but with a zero exposure value.

### *Expected Deaths*

Expected deaths in the study are based on 100% of the Society of Actuaries A75-80 Basic Select and Ultimate Tables (pages 205-227 of *TSA XXXVIII*, 1986). The tables vary by sex and age type (age nearest birthday and age last birthday).

The A75-80 Basic Tables were extended to issue age 90, and the resulting tables were used to calculate the expected mortality for issue ages over 70. In the 1990 study, the ultimate attained age was 100. Study years 1991 and later extended this ultimate age to 105 using the constant difference pattern implicit in the values at age 100 and immediately prior. The extension is described in Appendix F.

For substandard risks, the appropriate base table was increased by the appropriate substandard rating.

### *Actual Deaths*

Actual claims are the amounts actually paid by the reinsurer. In the case of contestable claims, the actual claim amount is that actually paid out, if any.

### *Other Comments*

Underwriting status refers to the standard and substandard categories. Preferred and nonpreferred risks are treated as Regular risks. Reinsurance status refers to how the participating company receives the business based on automatic, facultative, and shopped categories.

### *Participants in the Study*

For a complete list of participants in the study, see Appendix A. In the 1994 study, all participants from 1993 remained and one new participant entered.

### ***Products Included in the Study***

Permanent plans include whole life, limited pay plans and other permanent plans. Universal life plans are interest-sensitive plans with a cash value buildup. Term plans include re-entry, level and decreasing type plans.

## **HIGHLIGHTS OF THE STUDY (1994)**

### ***Overall Experience***

The experience (see Tables 1–6) underlying the year 1994 data is based on a total exposure of \$1.75 billion and claims of \$20.6 million. The total 1994 exposure by number is 10,831 policies and 222 deaths.

All participants from the 1993 study remained, and one new participant entered. There is a 29% increase in business from the previous participants and 8% from the new. The 1993 report is understated by \$139 M of exposures and \$5.5 M expected claims by amount. References to 1993 in this report have been revised.

The overall mortality ratio by amounts for the 1994 study is 34.4%. The overall mortality ratio by number for the 1994 study is 50.5%.

### ***Experience by Sex***

A total of 55% of the total exposure by amount was from policies issued on male lives.

The mortality ratio by amount for males is 28.3%. The mortality ratio for females is 46.9%. The 1993 report showed 60.0% and 30.5%, respectively.

The mortality ratios by number are 47.8% and 56.9% for males and females, respectively. The 1993 report showed 55.5% and 65.5%, respectively.

### ***Experience by Issue Age***

Almost all of the claims occur between the ages of 70 and 79 since over 97% of the exposure by both number and by amount is in this age range.

### ***Experience by Policy Years***

The mortality ratio by amount varies greatly by policy year, with the highest ratio at duration 16+. Interestingly, the mortality ratio by number in duration 1 is about one-half of duration 2. For durations 2–4, the mortality ratio is approximately 37% each year.

### *Experience by Classification Amount*

The < \$100,000 band showed the highest mortality ratio by amount and by number, and fluctuated between 40 and 50% for bands under \$1 M. A dramatic drop occurred in band \$1-3 M and spiked at \$3-5 M. Low exposures exist at the greater than \$5 M band.

The experience by classification amount in the study is calculated using one record per policy. If the experience was calculated using one record per life, several claims would move to higher classification amounts.

A total of 222 claims were reported. When analyzing each claim individually, it was possible to observe that some deaths involved multiple policies.

### *Experience by Smoking Status*

The mortality ratio by amount for nonsmoker is 32.0% (36.6% in 1993). The ratio for smoker is 75.1% (102.2% in 1993). The expected level of mortality for smoker is roughly 1.4 times the mortality for nonsmoker. The A75-80 Basic Tables are not differentiated by smoking status.

### *Experience by Underwriting Status*

The mortality ratio by amount for standard policies is 37.9%. The ratio is 26.0% for substandard policies. The exposure amounts are distributed 78.8% and 21.2%, respectively.

### *Experience by Reinsurance Status*

The mortality experience for facultative business is lower than the mortality experience for automatic business in 1994. The mortality ratio by amount for policies reinsured automatically is 45.2%, and for policies reinsured facultatively, 29.4%.

Facultative business accounted for over 66% by exposure amounts. There was no shopped business reported. Shopped policies are defined as those sent facultatively to one or more reinsurer(s) to obtain the most competitive underwriting assessment.

Historically, there is twice as much facultative business than automatic, with much mortality fluctuation in mortality ratios.

### *Experience by Plan of Insurance*

The plan of insurance was provided for 7,916 policies (73.1%; 72.4% in 1993). These were grouped as universal life (2,641 policies; 33.3%), whole life (1,503; 19.0%), and term (3,772; 47.7%).

***Experience by Method of Reinsurance***

The method of reinsurance was provided for 10,256 policies (94.7%). These were grouped as yearly renewable term (YRT) (8,784 policies; 85.6%), coinsurance (1,461; 14.3%), and modified coinsurance (11; 0.1%).

***Experience by Level of Retention***

The level of retention of the ceding company was provided for 4,515 policies (42%; 45% in 1993). These were grouped as full retention (3,910 policies), partial retention (207), and no retention (399).

TABLE 1

TRENDS IN MORTALITY RATIOS BY NUMBER OF POLICIES—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	1990	1991	1992	1993*	1994	1990-94
<b>Sex</b>						
Male	72.3%	58.6%	45.9%	55.5%	47.8%	54.9%
Female	63.0	73.7	60.5	65.5	56.9	63.2
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Issue Ages</b>						
70-74	82.2%	70.3%	56.4%	66.0%	52.4%	64.0%
75-79	44.1	46.2	42.3	46.3	49.5	45.8
80-84	54.6	31.7	11.0	39.5	35.1	33.4
85-89	98.4	246.5	0.0	0.0	0.0	85.1
90 and Over	0.0	81.3	0.0	0.0	0.0	25.4
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Policy Years</b>						
1	91.8%	67.1%	24.0%	45.3%	18.4%	46.4%
2	66.4	74.7	57.4	86.4	36.9	63.6
3	54.2	43.9	38.6	31.7	37.6	41.2
4	70.4	82.4	38.8	43.0	37.7	55.9
5	49.1	50.5	40.9	28.6	52.3	44.9
6-10	82.1	60.5	47.9	56.2	54.9	57.9
11-15	64.4	55.6	74.7	81.8	71.7	70.8
16 and Over†	68.2	217.2	253.9	374.0	61.0	118.0
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Classification Amounts</b>						
Less than \$100,000	70.5%	62.1%	54.3%	60.0%	61.4%	61.4%
\$100,000-\$249,999	82.6	73.7	46.1	64.0	45.8	60.0
\$250,000-\$499,999	58.5	43.3	61.5	62.2	51.8	55.4
\$500,000-\$999,999	39.6	67.1	22.5	50.0	43.3	43.4
\$1,000,000-\$1,999,999	56.1	33.6	55.4	36.1	20.4	38.3
\$2,000,000-\$2,999,999	0.0	61.4	76.8	41.5	12.8	40.8
\$3,000,000-\$4,999,999	181.0	33.1	0.0	38.8	80.7	63.4
\$5,000,000 and Over	0.0	176.5	0.0	0.0	41.2	42.1
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Smoking Status</b>						
Nonsmoker	67.0%	56.4%	35.1%	45.8%	45.6%	47.8%
Smoker	114.4	104.4	67.2	74.5	79.4	86.2
Aggregate	64.3	62.7	82.0	82.5	55.4	68.8
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Underwriting Status</b>						
Standard	69.6%	62.6%	52.7%	61.0%	52.2%	58.5%
Substandard	70.5	62.0	44.7	53.5	47.0	54.9
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Reinsurance Status</b>						
Automatic	76.0%	67.4%	58.1%	65.0%	54.9%	62.9%
Facultative	65.2	58.1	42.4	52.0	45.4	51.7
Shopped	0.0	0.0	0.0	0.0	0.0	0.0
All	70.0%	62.4%	49.9%	58.3%	50.5%	57.2%
<b>Plan of Insurance</b>						
Whole Life		61.9%	41.2%	55.2%	48.3%	
Term		54.9	43.2	43.8	32.7	
Universal Life		64.4	54.6	45.3	64.5	
Unknown		66.2	57.3	94.0	63.0	
All		62.4%	49.9%	58.3%	50.5%	
<b>Reinsurance Method</b>						
Coinsurance		111.2%	79.6%	90.8%	70.4%	
Modified Coinsurance		222.3	130.0	69.8	160.9	
Yearly Renewable Term		56.6	43.8	53.7	43.4	
Unknown		38.4	54.4	0.0	118.4	
All		62.4%	49.9%	58.3%	50.5%	

\*An error was found in the 1993 data. This affected the expected claim by number only. The previous reported mortality ratio for 1993 was 59.7%.

†The ultimate expected mortality ratios for duration 16 and over was found to be deficient for all study years prior to 1994, thus overstating the mortality ratios for those years. The overstatement was under 0.5% per year.

TABLE 2

TRENDS IN MORTALITY RATIOS BY AMOUNT (1,000's)—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	1990	1991	1992	1993*	1994	1990-94
Sex						
Male	35.3%	63.3%	39.9%	56.0%	28.3%	44.0%
Female	68.0	85.0	34.9	30.5	46.9	51.0
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Issue Ages						
70-74	41.5%	82.6%	43.7%	54.0%	31.1%	50.5%
75-79	30.0	50.4	33.5	42.2	39.0	39.3
80-84	122.5	10.1	1.8	7.0	46.3	36.3
85-89	1.4	2.4	0.0	0.0	0.0	0.8
90 and Over	0.0	1.8	0.0	0.0	0.0	0.5
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Policy Years						
1	120.0%	57.2%	8.5%	38.4%	10.6%	45.5%
2	36.2	160.3	28.2	96.9	30.4	74.0
3	10.1	38.0	31.7	13.4	17.6	23.7
4	23.6	45.6	7.1	40.4	8.4	24.5
5	34.9	16.9	28.9	15.4	27.5	24.7
6-10	44.2	79.4	56.0	42.9	53.7	56.1
11-15	40.2	30.6	43.1	100.3	38.1	49.7
16 and Over†	33.6	100.0	107.2	659.6	85.0	131.7
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Classification Amounts						
Less than \$100,000	50.1%	43.5%	36.4%	38.3%	54.0%	44.2%
\$100,000-\$249,999	64.0	60.1	43.4	50.5	40.0	51.1
\$250,000-\$499,999	35.5	40.7	51.8	53.0	50.5	46.9
\$500,000-\$999,999	26.7	41.3	29.5	58.8	45.1	40.7
\$1,000,000-\$1,999,999	53.1	34.1	48.7	37.4	20.5	37.6
\$2,000,000-\$2,999,999	0.0	52.9	81.5	58.7	27.4	48.8
\$3,000,000-\$4,999,999	123.6	101.4	0.0	68.9	45.0	62.9
\$5,000,000 and Over	0.0	258.5	0.0	0.0	3.8	55.4
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Smoking Status						
Nonsmoker	47.6%	56.9%	31.0%	36.6%	32.0%	39.3%
Smoker	34.1	152.3	70.4	102.2	75.1	87.8
Aggregate	38.7	79.9	55.2	76.7	34.1	57.2
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Underwriting Status						
Standard	41.6%	80.5%	36.2%	43.3%	37.9%	47.6%
Substandard	47.2	46.6	43.1	56.9	26.0	43.0
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Reinsurance Status						
Automatic	56.4%	20.5%	39.3%	37.7%	45.2%	38.4%
Facultative	38.1	100.5	38.0	52.0	29.4	50.4
Shopped	0.0	0.0	0.0	0.0	0.0	0.0
All	43.5%	69.3%	38.4%	47.4%	34.4%	46.2%
Plan of Insurance						
Whole Life		37.2%	19.5%	53.4%	33.5%	
Term		139.6	45.7	38.9	23.2	
Universal Life		33.1	52.1	53.3	46.0	
Unknown		72.9	39.1	44.8	36.9	
All		69.3%	38.4%	47.4%	34.4%	
Reinsurance Method						
Coinsurance		148.2%	16.1%	27.3%	19.0%	
Modified Coinsurance		17.4	108.1	12.0	33.7	
Yearly Renewable Term		60.4	39.7	49.6	30.6	
Unknown		76.1	68.7	0.0	197.1	
All		69.3%	38.4%	47.4%	34.4%	

\*An error was found in the 1993 data. This affected the expected claim by number only. The previous reported mortality ratio for 1993 was 54.5%.

†The ultimate expected mortality rates for duration 16 and over was found to be deficient for all study years prior to 1994, thus overstating the mortality ratios for those years. The overstatement was under 0.5% per year.

TABLE 3

1994 EXPERIENCE BY NUMBER OF POLICIES—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	Exposure	Actual Claims	Expected Claims	Mortality Ratio
Sex				
Male	6,426	148	309.32	47.8%
Female	4,405	74	130.07	56.9
All	10,831	222	439.39	50.5%
Issuance Ages				
70-74	8,411	150	286.40	52.4%
75-79	2,180	65	131.20	49.5
80-84	231	7	19.95	35.1
85-89	6	0	0.90	0.0
90 and Over	3	0	0.95	0.0
All	10,831	222	439.39	50.5%
Policy Years				
1	1,900	5	27.22	18.4%
2	1,517	11	29.85	36.9
3	1,382	14	37.25	37.6
4	1,299	16	42.48	37.7
5	951	20	38.23	52.3
6-10	3,104	103	187.55	54.9
11-15	561	41	57.15	71.7
16 and Over	118	12	19.67	61.0
All	10,831	222	439.39	50.5%
Classification Amounts				
Less than \$100,000	3,164	108	175.76	61.4%
\$100,000-\$249,999	3,008	55	120.03	45.8
\$250,000-\$499,999	1,690	28	54.07	51.8
\$500,000-\$999,999	1,407	20	46.20	43.3
\$1,000,000-\$1,999,999	1,042	6	29.37	20.4
\$2,000,000-\$2,999,999	288	1	7.82	12.8
\$3,000,000-\$4,999,999	129	3	3.72	80.7
\$5,000,000 and Over	104	1	2.43	41.2
All	10,831	222	439.39	50.5%
Smoking Status				
Nonsmoker	8,325	136	298.41	45.6%
Smoker	715	26	32.75	79.4
Aggregate	1,791	60	108.24	55.4
All	10,831	222	439.39	50.5%
Underwriting Status				
Standard	8,523	155	296.94	52.2%
Substandard	2,308	67	142.45	47.0
All	10,831	222	439.39	50.5%
Reinsurance Status				
Automatic	6,898	130	236.81	54.9%
Facultative	3,933	92	202.58	45.4
Shopped	0	0	0.00	0.0
All	10,831	222	439.39	50.5%
Plan of Insurance				
Whole Life	1,503	39	80.68	48.3%
Term	3,772	48	146.92	32.7
Universal Life	2,641	67	103.85	64.5
Unknown	2,915	68	107.95	63.0
All	10,831	222	439.39	50.5%
Reinsurance Method				
Coinsurance	1,461	38	54.01	70.4%
Modified Coinsurance	11	2	1.24	160.9
Yearly Renewable Term	8,784	158	363.87	43.4
Unknown	575	24	20.26	118.4
All	10,831	222	439.39	50.5%



TABLE 4

1994 EXPERIENCE BY AMOUNT (1,000's)—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	Exposure	Actual Claims	Expected Claims	Mortality Ratio
Sex				
Male	965,263	11,361	40,170	28.3%
Female	779,986	9,218	19,652	46.9
All	1,745,248	20,580	59,822	34.4%
Issue Ages				
70-74	1,315,979	11,417	36,689	31.1%
75-79	384,100	7,613	19,540	39.0
80-84	45,625	1,549	3,343	46.3
85-89	1,468	0	221	0.0
90 and Over	76	0	29	0.0
All	1,747,248	20,580	59,822	34.4%
Policy Years				
1	357,921	614	5,786	10.6%
2	295,502	1,738	5,712	30.4
3	252,530	1,126	6,398	17.6
4	208,194	554	6,594	8.4
5	166,699	1,805	6,558	27.5
6-10	406,114	12,334	22,981	53.7
11-15	55,449	2,044	5,364	38.1
16 and Over	2,839	365	429	85.0
All	1,745,248	20,580	59,822	34.4%
Classification Amounts				
Less than \$100,000	65,126	1,842	3,410	54.0%
\$100,000-\$249,999	176,713	3,076	7,691	40.0
\$250,000-\$499,999	201,471	3,696	7,321	50.5
\$500,000-\$999,999	318,239	5,515	12,220	45.1
\$1,000,000-\$1,999,999	444,734	2,926	14,301	20.5
\$2,000,000-\$2,999,999	208,984	1,681	6,129	27.4
\$3,000,000-\$4,999,999	136,853	1,650	3,670	45.0
\$5,000,000 and Over	193,130	193	5,079	3.8
All	1,745,248	20,580	59,822	34.4%
Smoking Status				
Nonsmoker	1,509,470	15,711	49,050	32.0%
Smoker	81,616	2,196	2,925	75.1
Aggregate	154,162	2,673	7,846	34.1
All	1,745,248	20,580	59,822	34.4%
Underwriting Status				
Standard	1,375,641	15,951	42,048	37.9%
Substandard	369,607	4,629	17,774	26.0
All	1,745,248	20,580	59,822	34.4%
Reinsurance Status				
Automatic	582,882	8,534	18,897	45.2%
Facultative	1,162,367	12,046	40,924	29.4
Shopped	0	0	0	0.0
All	1,745,248	20,580	59,822	34.4%
Plan of Insurance				
Whole Life	410,076	4,723	14,079	33.5%
Term	512,070	4,296	18,504	23.2
Universal Life	465,230	7,624	16,581	46.0
Unknown	357,872	3,936	10,658	36.9
All	1,745,248	20,580	59,822	34.4%
Reinsurance Method				
Coinsurance	169,906	946	4,973	19.0%
Modified Coinsurance	1,380	62	184	33.7
Yearly Renewable Term	1,537,327	16,206	52,956	30.6
Unknown	36,634	3,366	1,708	197.1
All	1,745,248	20,580	59,822	34.4%

TABLE 5  
1990-94 EXPERIENCE BY NUMBER OF POLICIES—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	Exposure	Actual Claims	Expected Claims	Mortality Ratio
Sex				
Male	29,422	746	1,357.95	54.9%
Female	18,312	320	506.15	63.2
All	47,734	1,066	1,864.10	57.2%
Issu e Ages				
70-74	37,376	780	1,218.84	64.0%
75-79	9,341	251	547.71	45.8
80-84	955	28	83.81	33.4
85-89	37	5	5.87	85.1
90 and Over	24	2	7.87	25.4
All	47,734	1,066	1,864.10	57.2%
Policy Years				
1	8,115	54	116.39	46.4%
2	7,227	93	146.21	63.6
3	6,399	72	174.75	41.2
4	5,690	108	193.28	55.9
5	4,845	89	198.32	44.9
6-10	12,860	446	770.72	57.9
11-15	2,213	162	228.84	70.8
16 and Over	385	42	35.60	118.0
All	47,734	1,066	1,864.10	57.2%
Classification Amounts				
Less than \$100,000	18,337	535	871.84	61.4%
\$100,000-\$249,999	12,592	288	480.04	60.0
\$250,000-\$499,999	6,226	109	196.80	55.4
\$500,000-\$999,999	4,999	69	158.82	43.4
\$1,000,000-\$1,999,999	3,662	40	104.41	38.3
\$2,000,000-\$2,999,999	998	11	26.94	40.8
\$3,000,000-\$4,999,999	520	10	15.76	63.4
\$5,000,000 and Over	401	4	9.49	42.1
All	47,734	1,066	1,864.10	57.2%
Smoking Status				
Nonsmoker	33,666	553	1,156.90	47.8%
Smoker	3,534	130	150.88	86.2
Aggregate	10,533	383	556.32	68.8
All	47,734	1,066	1,864.10	57.2%
Underwriting Status				
Standard	36,289	698	1,193.62	58.5%
Substandard	11,445	368	670.48	54.9
All	47,734	1,066	1,864.10	57.2%
Reinsurance Status				
Automatic	27,924	578	918.22	62.9%
Facultative	19,734	488	943.23	51.7
Shopped	75	0	2.66	0.0
All	47,734	1,066	1,864.10	57.2%

TABLE 6  
1990-94 EXPERIENCE BY AMOUNT (1,000's)—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	Exposure	Actual Claims	Expected Claims	Mortality Ratio
Sex				
Male	4,421,457	79,912	181,428	44.0%
Female	3,455,233	39,992	78,366	51.0
All	7,876,690	119,905	259,794	46.2%
Issue Ages				
70-74	6,121,189	84,522	167,272	50.5%
75-79	1,562,355	30,069	76,525	39.3
80-84	188,671	5,304	14,601	36.3
85-89	5,246	8	994	0.8
90 and Over	1,229	2	402	0.5
All	7,878,690	119,905	259,794	46.2%
Policy Years				
1	1,610,809	10,374	22,804	45.5%
2	1,464,948	20,769	28,058	74.0
3	1,168,597	7,125	30,065	23.7
4	893,312	7,118	29,045	24.5
5	741,569	7,191	29,117	24.7
6-10	1,787,031	56,982	101,506	56.1
11-15	196,677	9,048	18,214	49.7
16 and Over	13,748	1,297	985	131.7
All	7,876,690	119,905	259,794	46.2%
Classification Amounts				
Less than \$100,000	417,699	8,185	18,536	44.2%
\$100,000-\$249,999	887,223	18,304	35,844	51.1
\$250,000-\$499,999	884,961	14,745	31,421	46.9
\$500,000-\$999,999	1,395,170	20,175	49,541	40.7
\$1,000,000-\$1,999,999	1,840,738	21,614	57,545	37.6
\$2,000,000-\$2,999,999	837,163	11,514	23,606	48.8
\$3,000,000-\$4,999,999	685,720	11,599	18,433	62.9
\$5,000,000 and Over	928,016	13,770	24,869	55.4
All	7,876,690	119,905	259,794	46.2%
Smoking Status				
Nonsmoker	6,220,361	73,978	188,305	39.3%
Smoker	471,330	14,372	16,370	87.8
Aggregate	1,184,999	31,555	55,119	57.2
All	7,876,690	119,905	259,794	46.2%
Underwriting Status				
Standard	6,188,033	84,572	177,567	47.6%
Substandard	1,688,657	35,333	82,227	43.0
All	7,876,690	119,905	259,794	46.2%
Reinsurance Status				
Automatic	2,851,385	33,949	88,316	38.4%
Facultative	5,000,580	85,956	170,655	50.4
Shopped	24,724	0	824	0.0
All	7,876,690	119,905	259,794	46.2%

### CLAIMS ANALYSIS

A total of 17 companies submitted data for this mortality study. This study included the year 1994 mortality experience. A total of 222 claims were submitted. The cause of death was provided for all claims, except 14.

Tables 5 and 6 show the number of claims and the percentage of claims for each cause of death reported. A total of 11 out of 16 causes of death were reported. There were no reported cases for AIDS, aviation, motor vehicle, endocrine, and homicide.

The following seven categories list the different causes of death included in the analysis (See Tables 7-14):

Category	Cause of Death
"Misadventure"	Homicide Suicide Aviation Motor Vehicle Other Accident
Circulatory	Cardiovascular Cerebrovascular
All Respiratory	Respiratory Pneumonia
Cancer	Cancer
AIDS	AIDS
Other	Digestive Endocrine Genitourinary System Nervous System (Other than Cerebrovascular) Other Disease
Unknown	Unknown or Not Provided

#### *Experience by Cause of Death*

A total of 222 claims are included in the claims analysis. Of those, 87 (39.2%) have Circulatory for cause of death, and 70 (31.5%) have Cancer for cause of death. A total of 25 claims (11.3%) are reported in the Respiratory category.

A total of four "Misadventure" claims are reported, including one Suicide case.

***Experience by Sex***

A total of 148 claims are reported on male lives. This represents 66.7% of all the claims.

***Experience by Issue Age***

A total of 150 claims occur in the issue age group 70–74. Of those, 38.7% are Circulatory, 32.0% are Cancer, and 10.0% are Respiratory. Sixty-five claims are in the 75–79 age group, with 43.1% Circulatory, 33.8% Cancer, and 12.3% Respiratory. Seven claims are reported for ages 80 and over.

***Experience by Policy Years***

Circulatory deaths account for at least 25% in durations 1–4 and 35% in durations 5–15. Cancer claims increase in percentage by duration and drop significantly after five years. Respiratory deaths occur mostly after five years.

***Experience by Classification Amount***

A total of 73% of all claims are reported in the first two bands (i.e., amounts less than \$250,000). Almost 13% of claims are in the \$250,000–\$500,000 band, and 9% in the \$500,000–\$1,000,000 band.

Circulatory and Cancer claims account for over 60% of claims by band.

***Experience by Smoking Status***

As expected, 60% of smoker deaths are Cancer and 15% are Circulatory. Of nonsmokers, 40% were Circulatory and 29% Cancer.

***Experience by Reinsurance Status***

Over 58% of claims are reinsured on an automatic basis. The percentages of Circulatory and Cancer claims are similar for both automatic and facultative methods.

***Experience by Underwriting Status***

Approximately 70% of claims are rated as standard cases. Almost 35% of Standard cases are Circulatory deaths, and 33% are Cancer deaths.

TABLE 7  
NUMBER OF CLAIMS FOR EACH CAUSE OF DEATH BY SEX AND ISSUE AGES

Category	All	Male	Female	Issue Ages				
				70-74	75-79	80-84	85-89	90 and Over
Other Accident	3	3	0	3	0	0	0	0
Homicide	0	0	0	0	0	0	0	0
Suicide	1	1	0	1	0	0	0	0
Aviation	0	0	0	0	0	0	0	0
Motor Vehicle	0	0	0	0	0	0	0	0
"Misadventure"	4	4	0	4	0	0	0	0
Cardiovascular	74	53	21	50	24	0	0	0
Cerebrovascular	13	4	9	8	4	1	0	0
Circulatory	87	57	30	58	28	1	0	0
Respiratory	16	9	7	9	6	1	0	0
Pneumonia	9	7	2	6	2	1	0	0
All Respiratory	25	16	9	15	8	2	0	0
Cancer	70	48	22	48	22	0	0	0
AIDS	0	0	0	0	0	0	0	0
Other Disease	10	5	5	5	5	0	0	0
Digestive	6	6	0	5	0	1	0	0
Endocrine	0	0	0	0	0	0	0	0
Genitourinary	4	3	1	4	0	0	0	0
Nervous System	2	1	1	1	0	1	0	0
Other	22	15	7	15	5	2	0	0
Unknown	14	8	6	10	2	2	0	0
All	222	148	74	150	65	7	0	0

TABLE 8

NUMBER OF CLAIMS FOR EACH CAUSE OF DEATH BY POLICY YEARS

Category	Policy Years							
	1	2	3	4	5	6-10	11-15	16 and Over
Other Accident	0	0	0	1	0	2	0	0
Homicide	0	0	0	0	0	0	0	0
Suicide	0	0	0	1	0	0	0	0
Aviation	0	0	0	0	0	0	0	0
Motor Vehicle	0	0	0	0	0	0	0	0
“Misadventure”	0	0	0	2	0	2	0	0
Cardiovascular	3	4	2	3	7	34	13	8
Cerebrovascular	0	0	2	1	0	6	3	1
Circulatory	3	4	4	4	7	40	16	9
Respiratory	0	0	3	0	2	5	5	1
Pneumonia	0	0	0	0	1	4	4	0
All Respiratory	0	0	3	0	3	9	9	1
Cancer	1	5	7	9	5	34	8	1
AIDS	0	0	0	0	0	0	0	0
Other Disease	0	0	0	0	0	6	4	0
Digestive	0	1	0	1	1	3	0	0
Endocrine	0	0	0	0	0	0	0	0
Genitourinary	0	0	0	0	0	2	2	0
Nervous System	0	0	0	0	0	2	0	0
Other	0	1	0	1	1	13	6	0
Unknown	1	1	0	0	4	5	2	1
All	5	11	14	16	20	103	41	12

TABLE 9  
NUMBER OF CLAIMS FOR EACH CAUSE OF DEATH BY CLASSIFICATION AMOUNT

Category	Classification Amounts							
	Less than \$0.1 M	\$0.1-0.25 M	\$0.25-0.5 M	\$0.5-1 M	\$1-2 M	\$2-3 M	\$3-5 M	More than \$5 M
Other Accident	0	2	0	1	0	0	0	0
Homicide	0	0	0	0	0	0	0	0
Suicide	0	0	0	1	0	0	0	0
Aviation	0	0	0	0	0	0	0	0
Motor Vehicle	0	0	0	0	0	0	0	0
"Misadventure"	0	2	0	2	0	0	0	0
Cardiovascular	31	17	11	10	3	0	2	0
Cerebrovascular	10	1	0	1	1	0	0	0
Circulatory	41	18	11	11	4	0	2	0
Respiratory	7	8	0	1	0	0	0	0
Pneumonia	7	2	0	0	0	0	0	0
All Respiratory	14	10	0	1	0	0	0	0
Cancer	36	14	11	5	1	1	1	1
AIDS	0	0	0	0	0	0	0	0
Other Disease	7	2	1	0	0	0	0	0
Digestive	2	3	1	0	0	0	0	0
Endocrine	0	0	0	0	0	0	0	0
Genitourinary	2	2	0	0	0	0	0	0
Nervous System	.	0	0	0	1	0	0	0
Other	12	7	2	0	1	0	0	0
Unknown	5	4	4	1	0	0	0	0
All	108	55	28	20	6	1	3	1



TABLE 10

## NUMBER OF CLAIMS FOR EACH CAUSE OF DEATH BY SMOKING, UNDERWRITING, AND REINSURANCE STATUS

Category	Smoking Status			Underwriting Status		Reinsurance Status		
	Nonsmoker	Smoker	Aggregate	Standard	Substandard	Automatic	Facultative	Shopped
Other Accident	3	0	0	3	0	3	0	0
Homicide	0	0	0	0	0	0	0	0
Suicide	1	0	0	1	0	1	0	0
Aviation	0	0	0	0	0	0	0	0
Motor Vehicle	0	0	0	0	0	0	0	0
“Misadventure”	4	0	0	4	0	4	0	0
Cardiovascular	49	3	22	46	28	43	31	0
Cerebrovascular	7	1	5	8	5	8	5	0
Circulatory	56	4	27	54	33	51	36	0
Respiratory	8	2	6	15	1	13	3	0
Pneumonia	6	0	3	6	3	2	7	0
All Respiratory	14	2	9	21	4	15	10	0
Cancer	39	16	15	51	19	35	35	0
AIDS	0	0	0	0	0	0	0	0
Other Disease	3	2	5	7	3	6	4	0
Digestive	0	0	0	4	2	3	3	0
Endocrine	6	0	0	0	0	0	0	0
Genitourinary	2	0	2	4	0	4	0	0
Nervous System	1	1	0	1	1	0	2	0
Other	12	3	7	16	6	13	9	0
Unknown	11	1	2	9	5	12	2	0
All	136	26	60	155	67	130	92	0

TABLE 11

## PERCENTAGE OF CLAIMS FOR EACH CAUSE OF DEATH BY SEX AND ISSUE AGES

Category	All	Male	Female	Issue Ages				
				70-74	75-79	80-84	85-89	90 and Over
Other Accident	1.4%	2.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%
Homicide	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suicide	0.5	0.7	0.0	0.7	0.0	0.0	0.0	0.0
Aviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Motor Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
“Misadventure”	1.8%	2.7%	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%
Cardiovascular	33.3%	35.8%	28.4%	33.3%	36.9%	0.0%	0.0%	0.0%
Cerebrovascular	5.9	2.7	12.2	5.3	6.2	14.3	0.0	0.0
Circulatory	39.2%	38.5%	40.5%	38.7%	43.1%	14.3%	0.0%	0.0%
Respiratory	7.2%	6.1%	9.5%	6.0%	9.2%	14.3%	0.0%	0.0%
Pneumonia	4.1	4.7	2.7	4.0	3.1	14.3	0.0	0.0
All Respiratory	11.3%	10.8%	12.2%	10.0%	12.3%	28.6%	0.0%	0.0%
Cancer	31.5%	32.4%	29.7%	32.0%	33.8%	0.0%	0.0%	0.0%
AIDS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other Disease	4.5%	3.4%	6.8%	3.3%	7.7%	0.0%	0.0%	0.0%
Digestive	2.7	4.1	0.0	3.3	0.0	14.3	0.0	0.0
Endocrine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Genitourinary	1.8	2.0	1.4	2.7	0.0	0.0	0.0	0.0
Nervous System	0.9	0.7	1.4	0.7	0.0	14.3	0.0	0.0
Other	9.9%	10.1%	9.5%	10.0%	7.7%	28.6%	0.0%	0.0%
Unknown	6.3%	5.4%	8.1%	6.7%	3.1%	28.6%	0.0%	0.0%
All	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%	0.0%







APPENDIX A  
LIST OF PARTICIPANTS  
1994 INTERCOMPANY MORTALITY STUDY

Allianz Life Insurance Company of North America  
American United Life Insurance Company  
Cologne Life Reinsurance Company  
Continental Assurance Company (Re)  
Crown Life Insurance Company

Equitable Life Assurance Society (Re)  
Employers Reassurance Corporation  
Life Reassurance Corporation of America  
Manufacturers Life Insurance Company (Re)  
Mercantile & General (US)

Munich American Re  
Mutual Life of Canada (U.S.)  
Reinsurance Group of America Incorporated (U.S.)  
Reinsurance Group of America Incorporated (Canada)  
Sun Life Assurance Company of Canada (Re)

Swiss Re Life Company America  
Transamerica Occidental Life (Re)

## APPENDIX B

TABLE B-1

LIST OF LARGE CLAIMS OVER \$1 MILLION ON ONE LIFE FOR THE PERIOD 1994

Claim	Direct Face Amount	Sex	Age Group	Policy Year	Smoking Class	Rating	Cause of Death
1	3.00 M	Female	70-74	2	Aggregate	100%	Cardiovascular
2	3.00 M	Female	70-74	2	Aggregate	100	Cardiovascular
3	1.00 M	Female	70-74	6-10	Nonsmoker	100	Cardiovascular
4	1.00 M	Female	70-74	11-15	Smoker	100	Cancer
5	3.00 M	Male	70-74	6-10	Nonsmoker	100	Cancer
6	2.00 M	Male	70-74	6-10	Nonsmoker	100	Cancer
7	1.00 M	Female	75-79	1	Nonsmoker	200	Cardiovascular
8	15.26 M	Female	75-79	5	Nonsmoker	100	Cancer
9	1.00 M	Female	75-79	11-15	Aggregate	100	Cerebrovascular
10	1.00 M	Male	75-79	6-10	Nonsmoker	100	Cardiovascular
11	1.43 M	Female	80-84	6-10	Nonsmoker	100	Nervous system

TABLE B-2

LIST OF LARGE CLAIMS OVER \$1 MILLION ON ONE LIFE FOR THE PERIOD 1990-93

Claim	Direct Face Amount	Sex	Age Group	Policy Year	Smoking Class	Rating	Cause of Death
1	1.00 M	Female	70-74	2	Nonsmoker	200%	Cancer
2	2.51 M	Female	70-74	6-10	Aggregate	100	Cancer
3	4.28 M	Female	70-74	6-10	Smoker	100	Cancer
4	7.50 M	Female	70-74	6-10	Aggregate	100	Cancer
5	2.51 M	Female	70-74	6-10	Aggregate	100	Cancer
6	1.50 M	Female	70-74	6-10	Aggregate	100	Unknown
7	2.00 M	Female	75-79	1	Nonsmoker	100	Cancer
8	7.50 M	Male	70-74	2	Nonsmoker	100	Other Disease
9	1.00 M	Male	70-74	2	Aggregate	100	Digestive
10	5.00 M	Male	70-74	6-10	Aggregate	100	Cardiovascular
11	1.80 M	Male	75-79	3	Nonsmoker	150	Cancer
12	1.80 M	Male	75-79	3	Nonsmoker	150	Cancer
13	1.00 M	Male	80-84	2	Nonsmoker	100	Cardiovascular
14	4.21 M	Female	70-74	6-10	Aggregate	300	Cardiovascular
15	3.00 M	Female	80-84	1	Nonsmoker	100	Cardiovascular
16	1.94 M	Male	70-74	4	Nonsmoker	100	Pneumonia
17	1.15 M	Male	70-74	1	Nonsmoker	225	Cardiovascular
18	1.00 M	Female	70-74	5	Nonsmoker	100	Cancer
19	1.00 M	Male	70-74	2	Aggregate	150	Other Disease
20	1.00 M	Male	70-74	3	Nonsmoker	100	Cardiovascular
21	1.00 M	Male	70-74	6-10	Nonsmoker	100	Aviation
22	1.00 M	Male	70-74	6-10	Nonsmoker	100	Cancer
23	1.00 M	Female	70-74	6-10	Nonsmoker	100	Unknown
24	2.00 M	Female	70-74	6-10	Nonsmoker	100	Unknown
25	1.00 M	Female	70-74	6-10	Nonsmoker	100	Cancer
26	2.00 M	Female	70-74	6-10	Nonsmoker	100	Cancer
27	1.42 M	Female	70-74	2	Smoker	100	Cancer
28	1.42 M	Female	70-74	1	Aggregate	100	Cancer
29	1.56 M	Female	70-74	3	Aggregate	100	Cancer
30	1.90 M	Male	70-74	6-10	Aggregate	200	Cancer
31	2.00 M	Male	70-74	3	Nonsmoker	100	Other Accident
32	1.00 M	Male	70-74	6-10	Nonsmoker	100	Unknown
33	1.00 M	Male	70-74	6-10	Nonsmoker	250	Cerebrovascular
34	1.00 M	Male	70-74	6-10	Nonsmoker	100	Cancer
35	2.50 M	Male	70-74	6-10	Nonsmoker	250	Cancer
36	1.50 M	Male	70-74	2	Smoker	100	Cerebrovascular
37	1.30 M	Male	70-74	6-10	Smoker	100	Cerebrovascular
38	1.83 M	Male	70-74	4	Aggregate	100	Unknown
39	1.46 M	Male	70-74	6-10	Aggregate	200	Cancer
40	1.00 M	Male	70-74	6-10	Aggregate	100	Other Disease
41	2.28 M	Male	75-79	6-10	Nonsmoker	100	Cancer
42	1.00 M	Female	70-74	1	Nonsmoker	100	Homicide
43	1.00 M	Female	70-74	3	Nonsmoker	100	Cardiovascular
44	1.20 M	Female	70-74	4	Nonsmoker	100	Cancer
45	1.00 M	Male	70-74	3	Nonsmoker	150	Cancer
46	1.50 M	Male	70-74	6-10	Nonsmoker	100	Cardiovascular
47	2.24 M	Male	70-74	2	Smoker	100	Cardiovascular
48	1.13 M	Male	70-74	6-10	Smoker	100	Cardiovascular
49	3.00 M	Male	70-74	11-15	Aggregate	100	Cardiovascular
50	1.00 M	Male	75-79	2	Nonsmoker	100	Other Disease
51	2.00 M	Male	75-79	2	Nonsmoker	200	Cardiovascular



### APPENDIX C STANDARD DEVIATIONS

In the interest of readability, this report does not contain standard deviation of the numerous mortality ratios that are quoted.

Standard deviation can be obtained by the use of the following formula:

$$\text{Standard Deviation of Mortality Ratio} = \frac{\text{Mortality Ratio}}{\sqrt{\text{Actual Number of Deaths}}}$$

It is necessary to use the number of deaths in this formula even when the mortality ratio involved is based on an amount of insurance. The range of virtual certainty is plus or minus three times the standard deviation. Plus or minus the standard deviation itself indicates 68% likelihood. This assumes a normal distribution whereas the formula is binomial.

The mortality ratios for the 1994 and the 1990–94 experience by amount of insurance and their standard deviations are shown in Tables C-1 and C-2.

TABLE C-1  
 STANDARD DEVIATIONS\* FOR THE PERIOD 1994  
 (MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	Actual Claims	Mortality Ratio	Standard Deviation
All Combined	222	34.4%	2.31
Sex			
Male	148	28.3%	2.32
Female	74	46.9	5.45
Issue Ages			
70-74	150	31.1%	2.54
75-79	65	39.0	4.83
Policy Years			
6-10	103	53.7%	5.29
11-15	41	38.1	5.95
Classification: Amounts			
<\$100,000	108	54.0%	5.20
\$100,000-\$249,999	55	40.0	5.39
Smoking Status			
Nonsmoker	136	32.0%	2.75
Aggregate	60	34.1	4.40
Underwriting Status			
Standard	155	37.9%	3.05
Substandard	67	26.0	3.18
Reinsurance Status			
Automatic	130	45.2%	3.96
Facultative	92	29.4	3.07
Plan of Insurance			
Whole Life	39	33.5%	5.37
Term	48	23.2	3.35
Universal Life	67	46.0	5.62
Unknown	68	36.9	4.48
Reinsurance Method			
Coinsurance	38	19.0%	3.09
Yearly Renewable Term	158	30.6	2.43

\*Standard deviations are done for cases in which at least 35 deaths are observed.

TABLE C-2  
 STANDARD DEVIATIONS\* FOR THE PERIOD 1990-94  
 (MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Categories	Actual Claims	Mortality Ratio	Standard Deviation
All Combined	1,066	46.2%	1.41
Sex			
Male	746	44.0%	1.61
Female	320	51.0	2.85
Issue Ages			
70-74	780	50.5%	1.81
75-79	251	39.3	2.48
Policy Years			
1	54	45.5%	6.19
2	93	74.0	7.68
3	72	23.7	2.79
4	108	24.5	2.36
5	89	24.7	2.62
6-10	446	56.1	2.66
11-15	162	49.7	3.90
16 and Over	42	131.7	20.32
Classification Amounts			
< \$ 100,000	535	44.2%	1.91
\$ 100,000-\$249,999	288	51.1	3.01
\$ 250,000-\$499,999	109	46.9	4.49
\$ 500,000-\$999,999	69	40.7	4.90
\$1,000,000-\$1,999,999	40	37.6	5.94
Smoking Status			
Nonsmoker	553	39.3%	1.67
Smoker	130	87.8	7.70
Aggregate	383	57.2	2.93
Underwriting Status			
Standard	698	47.6%	1.80
Substandard	368	43.0	2.24
Reinsurance Status			
Automatic	578	38.4%	1.60
Facultative	488	50.4	2.28

\*Standard deviations are done for cases in which at least 35 deaths are observed.

## APPENDIX D

TABLE D-1

1994 EXPERIENCE BY NUMBER OF POLICIES—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Policy Years	Exposure	Actual Claims	Expected Claims	Mortality Ratio
Issue Ages 70-74				
1	1,391	1	13.97	7.2%
2	1,164	6	17.69	33.9
3	1,050	7	21.31	32.8
4	1,002	14	25.89	54.1
5	731	11	23.33	47.1
6-10	2,505	72	125.29	57.5
11-15	468	28	43.50	64.4
16 and Over	99	11	15.41	71.4
All	8,411	150	286.40	52.4%
Issue Ages 75-79				
1	447	4	10.22	39.1%
2	313	5	9.92	50.4
3	300	5	13.26	37.7
4	272	2	14.10	14.2
5	197	7	12.50	56.0
6-10	550	29	55.47	52.3
11-15	85	12	11.86	101.2
16 and over	16	1	3.87	25.8
All	2,180	65	131.20	49.5%

TABLE D-2

1994 EXPERIENCE BY AMOUNT ('000's)—AGES 70 AND OVER  
(MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES)

Policy Years	Exposure	Actual Claims	Expected Claims	Mortality Ratio
Issue Ages 70-74				
1	236,184	42	2,365	1.8%
2	225,352	1,540	3,292	46.8
3	202,338	960	4,156	23.1
4	155,750	551	3,921	14.1
5	124,049	509	3,881	13.1
6-10	324,234	6,414	14,721	43.6
11-15	45,455	1,038	3,976	26.1
16 and Over	2,617	364	377	96.6
All	1,315,979	11,417	36,689	31.1%
Issue Ages 75-79				
1	109,686	573	2,798	20.5%
2	60,895	198	1,886	10.5
3	43,544	151	1,759	8.6
4	48,206	3	2,308	0.1
5	38,612	1,213	2,303	52.7
6-10	73,322	4,472	7,130	62.7
11-15	9,619	1,003	1,303	77.0
16 and Over	217	1	51	1.1
All	384,100	7,613	19,540	39.0%

## APPENDIX E

TABLE E-1

1994 EXPERIENCE BY NUMBER OF POLICIES—AGES 70 AND OVER  
MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES

Plan of Insurance by Policy Years	Exposure	Actual Claims	Expected Claims	Mortality Ratio
<b>Permanent</b>				
1	211	0	3.42	0.0%
2	209	1	4.52	22.1
3	175	2	4.74	42.2
4	158	4	5.79	69.1
5	119	4	5.29	75.6
6-10	446	12	32.79	36.6
11-15	149	10	17.41	57.5
16 and Over	35	6	6.71	89.4
All	1,503	39	80.68	48.3%
<b>Term</b>				
1	737	1	9.78	10.2%
2	573	2	10.60	18.9
3	495	4	13.04	30.7
4	470	5	15.23	32.8
5	289	3	11.51	26.1
6-10	981	21	62.86	33.4
11-15	198	11	18.81	58.5
16 and Over	30	1	5.10	19.6
All	3,772	48	146.92	32.7%
<b>Universal Life</b>				
1	340	2	4.73	42.3%
2	302	4	6.29	63.6
3	345	4	9.90	40.4
4	332	2	11.30	17.7
5	270	8	11.89	67.3
6-10	1,019	45	57.13	78.8
11-15	32	2	2.61	76.7
16 and Over	0	0	0.00	0.0
All	2,641	67	103.85	64.5%
<b>Unknown</b>				
1	612	2	9.29	21.5%
2	432	4	8.44	47.4
3	367	4	9.57	41.8
4	339	5	10.15	49.2
5	272	5	9.53	52.4
6-10	659	25	34.78	71.9
11-15	181	18	18.33	98.2
16 and Over	52	5	7.86	63.6
All	2,915	68	107.95	63.0%

TABLE E-2

1994 EXPERIENCE BY AMOUNT (000's)—AGES 70 AND OVER  
MORTALITY RATIOS BASED ON THE 1975-80 BASIC TABLES

Plan of Insurance by Policy Years	Exposure	Actual Claims	Expected Claims	Mortality Ratio
<b>Permanent</b>				
1	86,657	0	1,457	0.0%
2	70,522	28	1,370	2.1
3	64,724	603	1,603	37.6
4	48,002	68	1,613	4.2
5	45,391	796	1,747	45.6
6-10	80,878	2,511	4,759	52.8
11-15	13,144	647	1,398	46.2
16 and Over	758	71	133	53.8
All	410,076	4,723	14,079	33.5%
<b>Term</b>				
1	92,966	42	1,349	3.1%
2	83,425	483	1,515	31.9
3	59,057	173	1,487	11.6
4	55,362	290	1,548	18.7
5	40,963	335	1,451	23.1
6-10	157,311	2,249	9,030	24.9
11-15	22,239	675	2,001	33.7
16 and Over	747	50	124	40.3
All	512,070	4,296	18,504	23.2%
<b>Universal Life</b>				
1	84,374	460	1,360	33.8%
2	67,509	254	1,440	17.7
3	71,988	163	2,053	8.0
4	64,377	48	2,234	2.1
5	56,733	488	2,520	19.4
6-10	113,394	6,110	6,450	94.7
11-15	6,855	100	525	19.0
16 and Over	0	0	0	0.0
All	465,230	7,624	16,581	46.0%
<b>Unknown</b>				
1	93,925	113	1,620	6.9%
2	74,046	971	1,387	70.0
3	56,760	187	1,256	14.9
4	40,453	149	1,199	12.4
5	23,611	185	841	22.0
6-10	54,532	1,464	2,742	53.4
11-15	13,211	623	1,440	43.3
16 and Over	1,335	244	173	141.0
All	357,872	3,936	10,658	36.9%

## APPENDIX F

### A75-80 EXTENSION

The A75-80 Mortality Tables provided sex distinct rates for both age nearest and age last birthday basis, up to the issue age 70 on a 15-year select period basis and up to the attained age 100 on an ultimate age basis. A further extension from ultimate age 100 to age 105 uses the constant difference pattern implicit in the values at age 100 and immediately prior. The A75-80 Extension provides rates for issue ages 71 to 90 with decreasing select periods.

This appendix outlines the derivation of the Extension.

#### STEP 1—CALCULATE SELECT TO ULTIMATE RATIOS FOR ISSUE AGES 70 AND BELOW

The basic analysis used to extend the A75-80 Table is the select to ultimate ratio.

$$\text{Ratio} = \frac{q_{[x]+t}^{\text{Select}}}{q_{x+t}^{\text{Ultimate}}}$$

The ratios for issue ages 70 and below were obtained using the A75-80 Male Age Nearest Birthday Table.

#### STEP 2—ESTABLISH THE SELECT PERIODS

Based on expected underwriting experience, the following select periods are used:

- a. A 15-year select period at issue age 70, decreasing by one every year until issue age 78 (7-year select period).
- b. A 6-year select period for issue ages 79 and 80.
- c. A 5-year select period for issue ages 81 and 82.
- d. A 4-year select period for issue ages 83, 84, and 85.
- e. A 3-year select period for issue ages 86 to 90.

#### STEP 3—DEVELOP THE RATIOS FOR ISSUE AGES 71 TO 90

##### *Duration 1*

The ratios are obtained by linear interpolation between the following expected ratios:

Issue Age	Ratio
70	0.45
83	0.60
88-90	0.85

*Duration 2*

The midpoint between duration 1 and duration 3 is used.

*Duration 3*

An expected ratio of 0.95 is used for issue ages 88 to 90. Then, a linear interpolation is done between the issue ages 70 and 88.

*Durations 4-5*

The ratios are obtained by linear interpolation from issue age 70 down to the first issue age for that duration that uses the ultimate rate.

*Durations 6-15*

The ratios are obtained by linear interpolation from the attained age 75 diagonal down to the first issue age for that duration that uses the ultimate rate.

Finally, some manual changes are made to smooth the ratios. These ratios can be found in Table F-1.

When the final ratios are attached to the A75-80 ratios below age 70, the transition is not smooth. A smoother transition can be obtained by changing some of the ratios in the triangle formed by the attained age 75 diagonal and issue age 70. See Tables F-2 and F-3.

Please note, however, for purposes of the Mortality Study the existing A75-80 tables are used for issue ages 70 and lower.

**STEP 4—CALCULATE MORTALITY RATES**

To obtain the extended  $q_x$ :

$$q_{[x]+t} = \text{Ratio}_{[x]+t} * q_{x+t}^{\text{Ultimate}}$$

The same ratios are applied to obtain the Male Age Nearest Birthday (Table F-4) and the Female Age Nearest Birthday (Table F-5).

In the 1990 study, the ultimate attained age is 100. Extension to attained age 105 uses the constant difference pattern implicit in the values at age 100 and immediately prior.

**STEP 5—AGE LAST BIRTHDAY**

The Age Last Birthday tables are obtained using the following formulas:

*Select*

$$q_{[x]-t}^{\text{last}} = \frac{q_{[x]-t}^{\text{nearest}} + q_{[x+1]-t}^{\text{nearest}}}{2}$$



*Ultimate*

$$q_{x+t}^{\text{last}} = \frac{q_{x+t}^{\text{nearest}} + q_{x+1-t}^{\text{nearest}}}{2}$$

*For issue age 90:*

$$q_{[90]+t}^{\text{last}} = \frac{q_{[90]+t}^{\text{nearest}}}{q_{[89]+t}^{\text{nearest}}} \times q_{[89]+t}^{\text{last}}$$

The Male Age Last Birthday and Female Age Last Birthday tables can be found in Tables F-6 and F-7, respectively.







TABLE F-4

## MORTALITY RATES -- MALE AGE NEAREST BIRTHDAY

Issue Age	Duration																Attained Age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
71	9.53	14.60	19.60	24.97	29.44	34.32	41.78	48.80	57.45	65.58	74.61	84.52	95.47	107.84	121.31	132.05	86
72	11.40	16.64	22.87	28.77	34.15	39.89	48.34	56.16	65.58	74.61	84.52	95.39	107.67	121.31	132.05	143.63	87
73	13.52	19.13	26.61	33.20	39.52	46.21	55.72	64.40	74.61	84.52	95.39	107.62	121.31	132.05	143.63	156.05	88
74	15.94	22.46	30.70	38.25	45.60	53.35	64.01	73.58	84.52	95.39	107.62	121.31	132.05	143.63	156.05	169.12	89
75	18.71	26.26	35.35	43.95	52.45	61.35	73.23	83.67	95.39	107.62	121.31	132.05	143.63	156.05	169.12	182.61	90
76	21.88	30.62	40.61	50.35	60.12	70.26	83.39	94.78	107.62	121.31	132.05	143.63	156.05	169.12	182.61	196.52	91
77	25.51	34.90	46.52	57.51	68.66	80.09	94.57	107.29	121.31	132.05	143.63	156.05	169.12	182.61	196.52	210.85	92
78	29.63	40.42	53.12	65.47	78.04	90.90	107.18	121.31	132.05	143.63	156.05	169.12	182.61	196.52	210.85	225.60	93
79	34.65	46.62	60.45	74.20	88.36	103.10	121.31	132.05	143.63	156.05	169.12	182.61	196.52	210.85	225.60	240.77	94
80	40.30	53.54	68.50	83.78	99.99	116.79	132.05	143.63	156.05	169.12	182.61	196.52	210.85	225.60	240.77	256.36	95
81	46.63	61.18	77.33	94.56	113.02	132.05	143.63	156.05	169.12	182.61	196.52	210.85	225.60	240.77	256.36	272.37	96
82	53.65	69.60	87.27	106.64	127.54	143.63	156.05	169.12	182.61	196.52	210.85	225.60	240.77	256.36	272.37	288.80	97
83	61.41	79.10	98.40	120.07	143.63	156.05	169.12	182.61	196.52	210.85	225.60	240.77	256.36	272.37	288.80	305.65	98
84	72.42	89.77	110.78	134.94	156.05	169.12	182.61	196.52	210.85	225.60	240.77	256.36	272.37	288.80	305.65	322.92	99
85	84.92	104.32	124.48	151.33	169.12	182.61	196.52	210.85	225.60	240.77	256.36	272.37	288.80	305.65	322.92	340.61	100
86	99.04	117.78	139.58	169.12	182.61	196.52	210.85	225.60	240.77	256.36	272.37	288.80	305.65	322.92	340.61	358.72	101
87	114.90	134.20	155.97	182.61	196.52	210.85	225.60	240.77	256.36	272.37	288.80	305.65	322.92	340.61	358.72	377.25	102
88	132.64	152.21	173.48	196.52	210.85	225.60	240.77	256.36	272.37	288.80	305.65	322.92	340.61	358.72	377.25	396.20	103
89	143.75	164.35	186.69	210.85	225.60	240.77	256.36	272.37	288.80	305.65	322.92	340.61	358.72	377.25	396.20	415.57	104
90	155.22	176.87	200.31	225.60	240.77	256.36	272.37	288.80	305.65	322.92	340.61	358.72	377.25	396.20	415.57	435.36	105

TABLE F-5

## MORTALITY RATES FEMALE AGE NEAREST BIRTHDAY

Issue Age	Duration																Attained Age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
71	5.01	7.70	10.44	13.52	16.24	19.36	24.15	28.95	35.02	41.07	47.96	55.76	64.57	74.44	85.13	93.91	86
72	6.01	8.87	12.38	15.87	19.26	23.05	28.68	34.23	41.07	47.96	55.76	64.51	74.32	85.13	93.91	103.24	87
73	7.20	10.35	14.68	18.73	22.84	27.42	33.97	40.33	47.96	55.76	64.51	74.28	85.13	93.91	103.24	113.12	88
74	8.63	12.39	17.32	22.10	27.06	32.52	40.08	47.30	55.76	64.51	74.28	85.13	93.91	103.24	113.12	123.55	89
75	10.32	14.81	20.43	26.07	31.97	38.41	47.07	55.20	64.51	74.28	85.13	93.91	103.24	113.12	123.55	134.53	90
76	12.34	17.69	24.09	30.69	37.65	45.16	55.01	64.10	74.28	85.13	93.91	103.24	113.12	123.55	134.53	146.06	91
77	14.74	20.71	28.36	36.01	44.13	52.83	63.96	74.06	85.13	93.91	103.24	113.12	123.55	134.53	146.06	158.14	92
78	17.58	24.64	33.26	42.08	51.48	61.48	73.98	85.13	93.91	103.24	113.12	123.55	134.53	146.06	158.14	170.77	93
79	21.12	29.19	38.86	48.95	59.76	71.17	85.13	93.91	103.24	113.12	123.55	134.53	146.06	158.14	170.77	183.95	94
80	25.23	34.42	45.19	56.66	69.02	81.96	93.91	103.24	113.12	123.55	134.53	146.06	158.14	170.77	183.95	197.68	95
81	29.98	40.36	52.30	65.27	79.31	93.91	103.24	113.12	123.55	134.53	146.06	158.14	170.77	183.95	197.68	211.96	96
82	35.39	47.07	60.24	74.83	90.70	103.24	113.12	123.55	134.53	146.06	158.14	170.77	183.95	197.68	211.96	226.79	97
83	41.53	54.60	69.05	85.39	103.24	113.12	123.55	134.53	146.06	158.14	170.77	183.95	197.68	211.96	226.79	242.17	98
84	49.99	63.00	78.78	97.00	113.12	123.55	134.53	146.06	158.14	170.77	183.95	197.68	211.96	226.79	242.17	258.10	99
85	59.59	74.19	89.47	109.70	123.55	134.53	146.06	158.14	170.77	183.95	197.68	211.96	226.79	242.17	258.10	274.58	100
86	70.43	84.66	101.18	123.55	134.53	146.06	158.14	170.77	183.95	197.68	211.96	226.79	242.17	258.10	274.58	291.61	101
87	82.59	97.28	113.94	134.53	146.06	158.14	170.77	183.95	197.68	211.96	226.79	242.17	258.10	274.58	291.61	309.19	102
88	96.15	111.20	127.80	146.06	158.14	170.77	183.95	197.68	211.96	226.79	242.17	258.10	274.58	291.61	309.19	327.32	103
89	105.02	121.08	138.76	158.14	170.77	183.95	197.68	211.96	226.79	242.17	258.10	274.58	291.61	309.19	327.32	346.00	104
90	114.35	131.45	150.23	170.77	183.95	197.68	211.96	226.79	242.17	258.10	274.58	291.61	309.19	327.32	346.00	365.23	105

TABLE F-6  
MORTALITY RATES—MALE AGE LAST BIRTHDAY

Issue Age	Duration																Attained Age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
71	10.47	15.62	21.23	26.87	31.79	37.10	45.06	52.48	61.52	70.10	79.56	89.95	101.57	114.58	126.68	137.84	86
72	12.46	17.88	24.74	30.99	36.83	43.05	52.03	60.28	70.10	79.56	89.95	101.50	114.49	126.68	137.84	149.84	87
73	14.73	20.79	28.66	35.72	42.56	49.78	59.87	68.99	79.56	89.95	101.50	114.47	126.68	137.84	149.84	162.59	88
74	17.32	24.36	33.02	41.10	49.03	57.35	68.62	78.63	89.95	101.50	114.47	126.68	137.84	149.84	162.59	175.87	89
75	20.30	28.44	37.98	47.15	56.29	65.81	78.31	89.23	101.50	114.47	126.68	137.84	149.84	162.59	175.87	189.57	90
76	23.70	32.76	43.56	53.93	64.39	75.18	88.98	101.03	114.47	126.68	137.84	149.84	162.59	175.87	189.57	203.69	91
77	27.57	37.66	49.82	61.49	73.35	85.50	100.87	114.30	126.68	137.84	149.84	162.59	175.87	189.57	203.69	218.23	92
78	32.14	43.52	56.79	69.83	83.20	97.00	114.24	126.68	137.84	149.84	162.59	175.87	189.57	203.69	218.23	233.19	93
79	37.47	50.08	64.48	78.99	94.18	109.95	126.68	137.84	149.84	162.59	175.87	189.57	203.69	218.23	233.19	248.57	94
80	43.47	57.36	72.91	89.17	106.51	124.42	137.84	149.84	162.59	175.87	189.57	203.69	218.23	233.19	248.57	264.37	95
81	50.14	65.39	82.30	100.60	120.28	137.84	149.84	162.59	175.87	189.57	203.69	218.23	233.19	248.57	264.37	280.59	96
82	57.53	74.35	92.83	113.35	135.58	149.84	162.59	175.87	189.57	203.69	218.23	233.19	248.57	264.37	280.59	297.23	97
83	66.91	84.44	104.59	127.51	149.84	162.59	175.87	189.57	203.69	218.23	233.19	248.57	264.37	280.59	297.23	314.29	98
84	78.67	97.04	117.63	143.14	162.59	175.87	189.57	203.69	218.23	233.19	248.57	264.37	280.59	297.23	314.29	331.77	99
85	91.98	111.05	132.03	160.23	175.87	189.57	203.69	218.23	233.19	248.57	264.37	280.59	297.23	314.29	331.77	349.67	100
86	106.97	125.99	147.77	175.87	189.57	203.69	218.23	233.19	248.57	264.37	280.59	297.23	314.29	331.77	349.67	367.99	101
87	123.77	143.21	164.72	189.57	203.69	218.23	233.19	248.57	264.37	280.59	297.23	314.29	331.77	349.67	367.99	386.73	102
88	138.20	158.28	180.09	203.69	218.23	233.19	248.57	264.37	280.59	297.23	314.29	331.77	349.67	367.99	386.73	405.89	103
89	149.49	170.61	193.50	218.23	233.19	248.57	264.37	280.59	297.23	314.29	331.77	349.67	367.99	386.73	405.89	425.47	104
90	161.41	183.60	207.61	233.19	248.57	264.37	280.59	297.23	314.29	331.77	349.67	367.99	386.73	405.89	425.47	445.47	105

TABLE F-7  
MORTALITY RATES--FEMALE AGE LAST BIRTHDAY

Issue Age	Duration																Attained Age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
71	5.51	8.28	11.41	14.70	17.75	21.20	26.41	31.59	38.04	44.51	51.86	60.13	69.44	79.78	89.52	98.58	86
72	6.61	9.61	13.53	17.30	21.05	25.24	31.32	37.28	44.51	51.86	60.13	69.40	79.72	89.52	98.58	108.18	87
73	7.92	11.37	16.00	20.42	24.95	29.97	37.02	43.81	51.86	60.13	69.40	79.71	89.52	98.58	108.18	118.34	88
74	9.47	13.60	18.87	24.09	29.51	35.47	43.58	51.25	60.13	69.40	79.71	89.52	98.58	108.18	118.34	129.04	89
75	11.33	16.25	22.26	28.38	34.81	41.79	51.04	59.65	69.40	79.71	89.52	98.58	108.18	118.34	129.04	140.30	90
76	13.54	19.20	26.22	33.35	40.89	49.00	59.49	69.08	79.71	89.52	98.58	108.18	118.34	129.04	140.30	152.10	91
77	16.16	22.67	30.81	39.05	47.81	57.16	68.97	79.59	89.52	98.58	108.18	118.34	129.04	140.30	152.10	164.46	92
78	19.35	26.92	36.06	45.51	55.62	66.32	79.55	89.52	98.58	108.18	118.34	129.04	140.30	152.10	164.46	177.36	93
79	23.18	31.80	42.02	52.80	64.39	76.56	89.52	98.58	108.18	118.34	129.04	140.30	152.10	164.46	177.36	190.82	94
80	27.61	37.39	48.74	60.97	74.17	87.93	98.58	108.18	118.34	129.04	140.30	152.10	164.46	177.36	190.82	204.82	95
81	32.68	43.71	56.27	70.05	85.01	98.58	108.18	118.34	129.04	140.30	152.10	164.46	177.36	190.82	204.82	219.38	96
82	38.46	50.83	64.64	80.11	96.97	108.18	118.34	129.04	140.30	152.10	164.46	177.36	190.82	204.82	219.38	234.48	97
83	45.76	58.80	73.91	91.19	108.18	118.34	129.04	140.30	152.10	164.46	177.36	190.82	204.82	219.38	234.48	250.14	98
84	54.79	68.59	84.13	103.35	118.34	129.04	140.30	152.10	164.46	177.36	190.82	204.82	219.38	234.48	250.14	266.34	99
85	65.01	79.42	95.33	116.62	129.04	140.30	152.10	164.46	177.36	190.82	204.82	219.38	234.48	250.14	266.34	283.10	100
86	76.51	90.97	107.56	129.04	140.30	152.10	164.46	177.36	190.82	204.82	219.38	234.48	250.14	266.34	283.10	300.40	101
87	89.37	104.24	120.87	140.30	152.10	164.46	177.36	190.82	204.82	219.38	234.48	250.14	266.34	283.10	300.40	318.26	102
88	100.58	116.14	133.28	152.10	164.46	177.36	190.82	204.82	219.38	234.48	250.14	266.34	283.10	300.40	318.26	336.66	103
89	109.68	126.27	144.50	164.46	177.36	190.82	204.82	219.38	234.48	250.14	266.34	283.10	300.40	318.26	336.66	355.62	104
90	119.43	137.09	156.45	177.36	190.82	204.82	219.38	234.48	250.14	266.34	283.10	300.40	318.26	336.66	355.62	375.12	105