TRANSACTIONS OF SOCIETY OF ACTUARIES
1975 VOL. 27

LIMRA 1971–72 EXPECTED LAPSE TABLES

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ABSTRACT

This report presents a new set of select and ultimate expected lapse tables. Twelve tables have been constructed: select tables for the first fifteen policy years, each by number and amount for pension insurance, high early-cash-value insurance, permanent insurance, and term insurance; and ultimate tables for the sixteenth and later policy years, each by number and amount for pension insurance and all other insurance excluding pension insurance. The select tables are for issue ages 0, 1, 2–4, 5–9, 10–14, and so forth, through age group 70 and over, and the ultimate tables are for individual attained ages 15–99.

The tables are based upon a selected subsample of the combined lapse experience of contributors to LIMRA's long-term lapse study observed between 1971 and 1972 policy anniversaries. Excluded from the calculations for expected tables were experience values that were unusually high due to a high proportion of expiries and nonrenewals counted as lapses; experience where corresponding lapse rates by number of policies and amount of insurance were not available; and certain subcategories, such as pension term insurance, that did not appear to fit into any major category very well but were not large enough to warrant a special category.

These tables are intended to replace the use of Linton and Moorhead lapse tables in the future analysis of lapse trends in the intercompany experience of the LIMRA long-term lapse study and to provide companies with an up-to-date basis for lapse comparisons of various kinds. Accordingly, these tables exhibit several characteristics which actuaries should take into consideration when using them for other purposes.

INTRODUCTION

THE most widely used expected lapse tables in the insurance industry are the Linton and the Moorhead tables. The Linton tables, long accepted as standards, were published by M. A. Linton in 1924 in the *Record of the American Institute of Actuaries* (*RAIA*, XIII, 283). The Moorhead tables were published by E. J. Moorhead in 1960 in these *Transactions* (*TSA*, XII, 545). These tables, variations of

them based upon company experience, or company experience tables are widely used by actuaries for asset share calculations, model-office projections, gross premium calculations, agents' compensation calculations, and various other purposes.

The Linton A and Moorhead S tables were used to calculate expected lapses for the contributions to the Life Insurance Marketing and Research Association's first long-term lapse study.[1] It was found, however, that neither the Linton nor the Moorhead tables were appropriate, since they did not reflect the substantial variation in lapse rates associated with an insured's age at issue, with characteristics of the insurance being purchased, and with the insured's attained age. As a result, it was decided to attempt the construction of a new set of expected lapse tables.

Twelve tables have been constructed: select tables for the first fifteen policy years by number of policies and by amount of insurance, each for pension insurance, high early-cash-value insurance, permanent insurance, and term insurance; and ultimate tables for the sixteenth and later policy years by number of policies and amount of insurance, for pension insurance and all other insurance combined. The select tables show expected lapses for issue ages 0, 1–4, 5–9, 10–14, 15–19, and so forth, through age group 70 and over, for each of the first fifteen years. The ultimate tables are for individual attained ages 15–99.

Nine companies contributed data on their total standard ordinary in-force to the LIMRA long-term lapse study. It was decided to use a subsample[2] of the entire contribution as a basis for constructing the new expected tables, excluding certain grouped portions of the contributed data, values that were seriously affected by inclusion of nonrenewals and expiries as lapses, experience where corresponding lapse rates by number of policies and amount of insurance were not available, and certain subcategories of the data, such as pension term insurance, that did not appear to fit into the various basic lapse categories and did not have sufficient experience to make a valid category. Although several years of data have to be combined to develop mortality tables, the much higher level of lapse rates makes it possible to develop tables with a much smaller volume of exposure.

DEVELOPMENT OF BASIC CATEGORIES

The first step in the development of the new tables was to decide on the nature and extent of the tables to be developed. The select and

[1] LIMRA, 1974, File 720. See Appendix I for details of this study (data collected, definitions, etc.).

[2] See Table 2 for sample size of ultimate data and Table 9 for sample size of select data.

ultimate experience was cross-tabulated, controlling on the various subdivisions of data that were contributed (type of underwriting, sex of the insured, term versus permanent, pension versus nonpension, and high early-cash-value insurance versus other insurance). The results of the cross-tabulation were graphed with select and ultimate experience on the same graph. For the purposes of this step, lapse rate was graphed against attained age (central attained age for grouped data). This process indicated that we should do the following:

1. Reflect the variations in lapse rate by age at issue, duration from issue, and attained age, and also for four kinds of insurance—pension, high early-cash-value, permanent, and term. Significant lapse patterns across age and duration were exhibited by all four categories. Although the other characteristics exhibited some effect on lapse rates, the basic patterns of lapses across age and duration were very similar. It was decided to develop the expected tables with only the categories that had significantly different patterns of lapse rate and later analyze the data for possible transformations of the basic rates to make them more applicable to other categories.
2. Not attempt to force the select rates to merge smoothly into the ultimate rates. The actual select rates approached the ultimate rates only at the young adult ages, diverging from the ultimate after attained age 35 (approximately) and becoming too variable after attained ages in the late fifties to draw any reliable conclusion. In contrast to mortality tables in which select rates are lower than ultimate, the select lapse rates are generally much higher than the ultimate lapse rates. There may be various causes for these differences between rates, such as (*a*) a different fundamental purpose for purchasing life insurance at the middle select ages as compared with that purchased years earlier by policyholders in the attained-age category for ultimate; (*b*) a higher proportion of paid-up insurance being in the ultimate experience; (*c*) a tendency for policyholders deciding to lapse or surrender insurance to drop the more recently purchased or higher premium insurance (could cash flow be a more important consideration for such policyholders than need for immediate funds?); or even (*d*) poorer mortality risks lapsing earlier during the select period.
3. Reflect the sharp breaks in lapse rates associated with the attainment of ages 21 and 65. The graphs indicated that sharp increases in lapsation are associated with the attainment of retirement age and legal age. Preserving such variation was deemed desirable but created the need for special graduation procedures. The solution used was that the ultimate rates be graduated first and ratios of select to ultimate (graduated rates) be graduated to create a set of select rates.

ULTIMATE TABLES

In the development of the ultimate tables, select experience at attained ages 0–19 was considered as ultimate and added to the ultimate data.

The rates were graduated using a Whittaker-Henderson type B graduation process in three pieces—ages 0–19, ages 20–64, and ages 65–99. For the nonpension[3] business the graduation was on the lapse rates, and for the pension business the graduation was on the ratio of the pension rates to the graduated nonpension rates; ratios were extrapolated to the very high and very young attained ages. The graduated lapse rates are shown in Table 1, and the test of graduation is shown in Table 2.

SELECT TABLES

Permanent and Term Insurance

Expected lapse rates were produced for permanent life insurance (excluding pension insurance and high early-cash-value insurance), graduating the ratios of select to ultimate rates with a Whittaker-Henderson type B process. This was first done across age groups within durations emphasizing fit, and then across durations within age groups emphasizing smoothness. Within age groups, minor transformations were made to improve fit on an overall basis. Investigation of the results indicated that the Whittaker-Henderson process had introduced some systematic deviations between actual and graduated rates, especially at the early durations. A "dummy variable" multiple regression process was developed to transform the rates at durations 1, 2, 3–5 combined, 6–10 combined, and 11–15 combined to improve fit. Actually, this process forced the actual and expected lapses based upon transformed rates to be equal within each of these duration groups. The same process was repeated with the term experience, except that the lapse rates at early ages and older ages were created by extrapolating ratios of term to permanent rates at these ages. The graduated select lapse rates are shown in Table 3, and the associated tests are shown in Table 4.

Pension and High Early-Cash-Value Insurance

The experience on pension insurance and high early-cash-value insurance presented additional problems, since many data cells did not have sufficient volume to develop significant lapse rates. However, the experience that did exist indicated that these groups had lapse patterns significantly different from those of term or permanent insurance (different patterns without as much variation by age at issue or attained age). For this experience a semi-Bayesian method was chosen to develop a graduated set of rates by duration alone, which was used to enrich the ungraduated data (an artificial experience producing a credibility of five

[3] "Nonpension" included experience of contributors who did not subdivide between pension and nonpension.

TABLE 1

GRADUATED ULTIMATE LAPSE RATES

Attained Age	Pension		Other than Pension		Attained Age	Pension		Other than Pension	
	Number	Amount	Number	Amount		Number	Amount	Number	Amount
15	.0209	.0201	.0125	.0139	58	.1250	.0972	.0150	.0186
16	.0245	.0236	.0144	.0163	59	.1346	.1035	.0155	.0194
17	.0297	.0287	.0184	.0198	60	.1376	.1055	.0155	.0195
18	.0350	.0337	.0228	.0233	61	.1401	.1086	.0156	.0198
19	.0389	.0375	.0247	.0259	62	.1507	.1209	.0175	.0218
20	.0636	.0614	.0527	.0424	63	.1773	.1498	.0221	.0269
21	.0633	.0611	.0501	.0422	64	.2464	.3000	.0330	.0400
22	.0629	.0607	.0497	.0419	65	.2027	.2000	.0280	.0360
23	.0623	.0601	.0497	.0415	66	.1318	.1400	.0178	.0260
24	.0609	.0588	.0487	.0406	67	.0941	.1009	.0161	.0209
25	.0588	.0568	.0468	.0392	68	.0764	.0925	.0154	.0191
26	.0560	.0540	.0443	.0373	69	.0676	.0839	.0153	.0193
27	.0525	.0507	.0413	.0350	70	.0591	.0761	.0151	.0197
28	.0486	.0469	.0384	.0324	71	.0490	.0662	.0145	.0196
29	.0449	.0433	.0356	.0299	72	.0378	.0547	.0139	.0189
30	.0416	.0401	.0331	.0277	73	.0269	.0432	.0135	.0179
31	.0386	.0372	.0307	.0257	74	.0260	.0334	.0134	.0173
32	.0357	.0345	.0286	.0238	75	.0255	.0246	.0135	.0170
33	.0333	.0322	.0268	.0222	76	.0255	.0246	.0135	.0170
34	.0317	.0306	.0254	.0211	77	.0261	.0252	.0136	.0174
35	.0305	.0294	.0243	.0203	78	.0269	.0259	.0138	.0179
36	.0296	.0285	.0232	.0197	79	.0276	.0266	.0142	.0184
37	.0290	.0280	.0221	.0193	80	.0281	.0271	.0148	.0187
38	.0284	.0274	.0213	.0189	81	.0282	.0272	.0156	.0188
39	.0278	.0268	.0205	.0185	82	.0284	.0274	.0164	.0189
40	.0272	.0262	.0196	.0181	83	.0285	.0275	.0174	.0190
41	.0264	.0255	.0186	.0176	84	.0294	.0284	.0185	.0196
42	.0257	.0248	.0176	.0171	85	.0312	.0301	.0196	.0208
43	.0248	.0239	.0168	.0165	86	.0332	.0320	.0206	.0221
44	.0242	.0272	.0164	.0161	87	.0353	.0340	.0216	.0235
45	.0257	.0337	.0162	.0159	88	.0375	.0362	.0228	.0250
46	.0285	.0355	.0161	.0159	89	.0399	.0385	.0242	.0266
47	.0315	.0374	.0159	.0159	90	.0428	.0413	.0261	.0285
48	.0356	.0401	.0155	.0159	91	.0461	.0445	.0287	.0307
49	.0410	.0437	.0150	.0159	92	.0503	.0485	.0323	.0335
50	.0477	.0482	.0145	.0159	93	.0552	.0533	.0377	.0368
51	.0556	.0534	.0141	.0159	94	.0611	.0589	.0452	.0407
52	.0643	.0590	.0140	.0159	95	.0683	.0659	.0551	.0455
53	.0724	.0637	.0139	.0158	96	.0767	.0740	.0674	.0511
54	.0789	.0670	.0138	.0155	97	.0863	.0833	.0821	.0575
55	.0859	.0708	.0137	.0154	98	.0995	.0937	.0993	.0647
56	.0966	.0779	.0138	.0161	99	.1000	.1000	.1000	.0700
57	.1113	.0881	.0142	.0174					

TABLE 2

TEST OF ULTIMATE GRADUATION

ATTAINED AGE(S)	EXPOSED TO RISK		ACTUAL LAPSES		EXPECTED LAPSES		RATIO ACTUAL/EXPECTED		LAPSE RATE ACTUAL/EXPOSED	
	Number	Amount ($000)	Number	Amount ($000)	Number	Amount ($000)	Number %	Amount %	Number %	Amount %
	Pension Business Only									
15–19	51	73	0	0	2	2	0.0	0.0	0.0	0.0
20–24	68	92	7	11	4	6	163.9	197.2	10.3	11.9
25–29	44	68	1	1	2	3	43.5	29.8	2.3	1.5
30–34	24	50	2	2	1	2	234.8	113.7	8.3	4.0
35–39	173	753	4	20	5	21	80.5	95.2	2.3	2.6
40–49	4,813	26,408	159	1,040	151	930	105.3	111.8	3.3	3.9
50–59	12,340	63,508	1,118	5,013	1,109	4,699	100.8	106.7	9.1	7.9
60–63	4,442	22,115	665	2,539	667	2,635	99.7	96.4	15.0	11.5
64	895	4,685	254	1,394	221	1,405	115.2	99.2	28.4	29.8
65	230	1,134	26	228	47	227	55.8	100.4	11.3	20.1
66–69	579	3,453	29	128	58	376	50.2	34.0	5.0	3.7
70–79	422	3,394	13	41	17	164	76.2	25.2	3.1	1.2
80–99	18	155	0	0	1	4	0.0	0.0	0.0	0.0
All ages	24,099	125,888	2,278	10,416	2,284	10,474	99.8	99.4	9.5	8.3
	Nonpension and Pension Not Subdivided Combined									
15–19	81,256	158,485	1,538	3,194	1,581	3,287	97.3	97.2	1.9	2.0
20–24	123,061	228,494	6,200	9,582	6,179	9,530	100.3	100.5	5.0	4.2
25–29	87,752	194,165	3,617	6,641	3,638	6,749	99.4	98.4	4.1	3.4
30–34	65,979	204,140	1,885	4,807	1,906	4,877	98.9	98.6	2.9	2.4
35–39	101,237	395,592	2,246	7,703	2,232	7,593	100.6	101.4	2.2	1.9
40–49	489,696	2,272,349	8,097	37,585	8,074	37,059	100.3	101.4	1.7	1.7
50–59	728,793	3,223,423	10,388	53,533	10,390	53,390	100.0	100.3	1.4	1.7
60–63	275,920	1,103,274	4,626	22,946	4,862	24,156	95.1	95.0	1.7	2.1
64	64,629	250,508	2,120	10,027	2,133	10,020	99.4	100.1	3.3	4.0
65	50,936	199,392	1,416	7,188	1,426	7,178	99.3	100.1	2.8	3.6
66–69	175,403	675,276	2,836	14,430	2,846	14,531	99.7	99.3	1.6	2.1
70–79	249,121	911,464	3,485	16,660	3,480	16,657	100.1	100.0	1.4	1.8
80–99	69,436	225,621	1,279	4,643	1,273	4,695	100.4	98.9	1.8	2.1
All ages	2,563,219	10,042,183	49,733	198,939	50,020	199,724	99.4	99.6	1.9	2.0

lapses with the table by duration was added to the raw data of each issue-age group and duration); the enriched experience was graduated emphasizing fit, and minor changes were made to improve smoothness. Raw and select lapse rates for pension insurance are shown in Table 5 with the test of graduation in Table 6; corresponding rates for the high early-cash-value tables are shown in Table 7 with the test of graduation in Table 8.

OVERALL TEST

The results of testing the select graduation with all the tables combined is shown in Table 9.

FURTHER RESEARCH

At the present time the new tables are being used as the basis of expected lapses for the 1972–73 policy-year contributions to the LIMRA long-term lapse study to help in analyzing the effects of various policy characteristics. For this purpose, the pension tables are used for pension business, the high early-cash-value tables are used for nonpension high early-cash-value insurance or high early-cash-value insurance where pension coding is unknown; the term tables are used for all term except pension term; and the permanent tables are used in all other cases. Additional research is also being conducted with the sample data that went into the creation of the new expected lapse tables to see whether simple transformations of the basic expected tables can reflect the effect of introducing additional policy characteristics, such as sex, underwriting, and average policy size, and to determine the nature of the variability in lapse rates actually experienced. Experience so far indicates that variance in rates is primarily a function of the magnitude of the expected lapse rate and the size of the experience cell. The current research is aimed at better quantifying this variability. We are also examining the data for more than a single year for individual contributors, to see whether simple transformations of the expected tables can be made to determine a company expected table.

TABLE 3

RAW SELECT LAPSE RATES—PERMANENT LIFE INSURANCE

AGE	POLICY YEAR														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.1133	.0528	.0395	.0315	.0297	.0246	.0229	.0193	.0174	.0157	.0132	.0118	.0126	.0133	.0149
1	.1509	.0549	.0446	.0350	.0307	.0261	.0219	.0187	.0158	.0168	.0142	.0116	.0082	.0101	.0136
2–4	.1909	.0686	.0435	.0315	.0302	.0234	.0216	.0223	.0158	.0140	.0168	.0131	.0154	.0152	.0203
5–9	.1910	.0713	.0380	.0275	.0248	.0263	.0164	.0179	.0163	.0198	.0235	.0231	.0308	.0352	.0414
10–14	.1436	.0570	.0279	.0205	.0228	.0254	.0255	.0247	.0292	.0382	.0354	.0359	.0351	.0395	.0430
15–19	.2152	.0874	.0479	.0421	.0450	.0453	.0428	.0433	.0391	.0404	.0383	.0342	.0291	.0316	.0268
20–24	.2718	.1163	.0656	.0551	.0508	.0436	.0393	.0367	.0328	.0300	.0285	.0251	.0248	.0223	.0215
25–29	.2263	.0933	.0547	.0460	.0434	.0369	.0343	.0298	.0267	.0241	.0241	.0227	.0209	.0191	.0179
30–34	.1971	.0791	.0486	.0446	.0406	.0348	.0314	.0291	.0245	.0235	.0215	.0196	.0190	.0192	.0175
35–39	.1730	.0681	.0462	.0475	.0416	.0324	.0274	.0238	.0220	.0211	.0216	.0171	.0176	.0162	.0173
40–44	.1437	.0579	.0400	.0436	.0350	.0311	.0263	.0234	.0225	.0196	.0206	.0190	.0162	.0168	.0164
45–49	.1277	.0510	.0427	.0434	.0344	.0266	.0257	.0246	.0211	.0220	.0229	.0207	.0197	.0209	.0266
50–54	.1136	.0476	.0408	.0404	.0369	.0293	.0274	.0260	.0249	.0274	.0282	.0297	.0326	.0361	.0307
55–59	.1008	.0469	.0422	.0455	.0347	.0389	.0351	.0363	.0337	.0344	.0362	.0233	.0241	.0099	.0251
60–64	.0833	.0764	.0395	.0404	.0473	.0370	.0255	.0268	.0193	.0269	.0222	.0127	.0254	.0141	.0194
65–69	.0812	.0548	.0320	.0395	.0393	.0354	.0197	.0167	.0163	.0150	.0278	.0109	.0185	.0175	.0333
70–99	.1091	.1301	.0160	.0294	.0000	.0142	.0205	.0611	.0435	.0244	.0000	.0571	.0000	.0000	.0000
	Amount of Insurance														
0	.1048	.0511	.0391	.0286	.0300	.0237	.0234	.0186	.0169	.0159	.0165	.0126	.0134	.0139	.0148
1	.1461	.0499	.0477	.0317	.0258	.0244	.0188	.0132	.0161	.0154	.0156	.0112	.0070	.0101	.0149
2–4	.1677	.0576	.0380	.0269	.0303	.0197	.0201	.0186	.0131	.0148	.0226	.0106	.0138	.0182	.0200
5–9	.1415	.0567	.0334	.0272	.0220	.0166	.0129	.0326	.0150	.0157	.0189	.0218	.0277	.0342	.0384
10–14	.1064	.0440	.0222	.0166	.0176	.0197	.0169	.0226	.0223	.0247	.0248	.0287	.0289	.0309	.0314
15–19	.2137	.0823	.0444	.0385	.0400	.0398	.0373	.0378	.0338	.0369	.0352	.0328	.0266	.0289	.0262
20–24	.2607	.1081	.0655	.0557	.0485	.0425	.0367	.0356	.0308	.0292	.0291	.0233	.0227	.0206	.0218
25–29	.1908	.0767	.0512	.0486	.0431	.0359	.0363	.0314	.0262	.0254	.0225	.0222	.0241	.0180	.0171
30–34	.1453	.0611	.0437	.0499	.0459	.0359	.0313	.0273	.0258	.0235	.0193	.0191	.0175	.0201	.0153
35–39	.1236	.0552	.0429	.0510	.0429	.0309	.0312	.0248	.0295	.0250	.0201	.0191	.0201	.0192	.0209
40–44	.0980	.0460	.0354	.0464	.0348	.0323	.0330	.0289	.0295	.0255	.0260	.0184	.0205	.0205	.0170
45–49	.0907	.0449	.0442	.0451	.0341	.0281	.0261	.0281	.0275	.0257	.0365	.0297	.0253	.0230	.0285
50–54	.1018	.0451	.0500	.0384	.0421	.0291	.0284	.0292	.0260	.0296	.0368	.0245	.0317	.0366	.0305
55–59	.0776	.0442	.0439	.0415	.0516	.0350	.0317	.0354	.0333	.0337	.0366	.0267	.0198	.0068	.0169
60–64	.0624	.0581	.0263	.0362	.0334	.0348	.0467	.0464	.0185	.0329	.0283	.0298	.0433	.0078	.0191
65–69	.0535	.0532	.0385	.0171	.0284	.0609	.0555	.0126	.0178	.0218	.0759	.0184	.0228	.0439	.0288
70–99	.0401	.1128	.0156	.0891	.0000	.0028	.0593	.0798	.0267	.0429	.0000	.0716	.0000	.0000	.0000

TABLE 3—*Continued*

GRADUATED SELECT LAPSE RATES—PERMANENT LIFE INSURANCE

Age	Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.1120	.0556	.0399	.0337	.0321	.0258	.0231	.0199	.0171	.0151	.0127	.0125	.0124	.0121	.0117
1	.1512	.0619	.0433	.0364	.0335	.0255	.0220	.0191	.0172	.0157	.0127	.0124	.0121	.0117	.0119
2–4	.1911	.0681	.0413	.0332	.0316	.0254	.0228	.0199	.0176	.0162	.0141	.0139	.0143	.0156	.0187
5–9	.1912	.0701	.0389	.0295	.0281	.0227	.0210	.0192	.0183	.0188	.0197	.0248	.0294	.0332	.0382
10–14	.1439	.0539	.0304	.0234	.0253	.0244	.0283	.0292	.0290	.0301	.0328	.0342	.0353	.0362	.0379
15–19	.2153	.0843	.0471	.0391	.0461	.0459	.0446	.0407	.0373	.0359	.0360	.0357	.0344	.0325	.0303
20–24	.2718	.1168	.0662	.0530	.0519	.0441	.0404	.0358	.0319	.0294	.0276	.0265	.0253	.0237	.0219
25–29	.2264	.0931	.0556	.0457	.0445	.0371	.0336	.0295	.0263	.0243	.0228	.0222	.0215	.0202	.0182
30–34	.1972	.0792	.0494	.0421	.0419	.0351	.0320	.0280	.0245	.0224	.0206	.0201	.0197	.0190	.0177
35–39	.1732	.0697	.0472	.0421	.0415	.0334	.0288	.0244	.0215	.0204	.0192	.0190	.0181	.0170	.0171
40–44	.1440	.0582	.0422	.0386	.0384	.0311	.0274	.0237	.0214	.0205	.0194	.0190	.0180	.0168	.0169
45–49	.1280	.0520	.0410	.0382	.0377	.0303	.0268	.0238	.0222	.0220	.0217	.0219	.0217	.0218	.0248
50–54	.1140	.0468	.0401	.0384	.0385	.0316	.0288	.0260	.0249	.0256	.0288	.0314	.0316	.0309	.0313
55–59	.1012	.0459	.0420	.0406	.0413	.0373	.0364	.0342	.0333	.0328	.0304	.0272	.0245	.0227	.0239
60–64	.0837	.0659	.0568	.0486	.0435	.0311	.0263	.0238	.0225	.0212	.0190	.0173	.0160	.0158	.0177
65–69	.0816	.0507	.0448	.0391	.0357	.0277	.0246	.0216	.0189	.0171	.0149	.0151	.0170	.0211	.0276
70–99	.1095	.0819	.0644	.0497	.0393	.0278	.0242	.0222	.0205	.0188	.0160	.0143	.0121	.0096	.0070
	Amount of Insurance														
0	.0995	.0506	.0425	.0356	.0331	.0236	.0225	.0207	.0186	.0167	.0162	.0150	.0143	.0139	.0140
1	.1597	.0564	.0425	.0358	.0331	.0225	.0207	.0186	.0167	.0151	.0150	.0143	.0139	.0140	.0150
2–4	.1694	.0605	.0450	.0369	.0327	.0204	.0178	.0156	.0136	.0118	.0117	.0109	.0115	.0137	.0176
5–9	.1427	.0529	.0409	.0332	.0299	.0175	.0169	.0171	.0176	.0187	.0208	.0249	.0291	.0337	.0390
10–14	.1097	.0337	.0331	.0286	.0273	.0158	.0196	.0231	.0257	.0275	.0291	.0290	.0290	.0289	.0288
15–19	.2123	.0855	.0543	.0423	.0397	.0352	.0351	.0350	.0349	.0339	.0318	.0293	.0269	.0248	.0232
20–24	.2606	.1057	.0629	.0492	.0435	.0385	.0366	.0347	.0324	.0296	.0273	.0248	.0227	.0211	.0199
25–29	.1915	.0789	.0545	.0451	.0410	.0347	.0321	.0295	.0267	.0242	.0226	.0207	.0191	.0172	.0155
30–34	.1454	.0621	.0503	.0440	.0411	.0349	.0320	.0289	.0259	.0230	.0214	.0197	.0186	.0179	.0175
35–39	.1233	.0561	.0494	.0440	.0410	.0344	.0316	.0289	.0262	.0239	.0224	.0210	.0201	.0200	.0199
40–44	.0986	.0450	.0444	.0406	.0388	.0330	.0319	.0306	.0291	.0271	.0253	.0232	.0215	.0203	.0194
45–49	.0915	.0448	.0454	.0413	.0387	.0315	.0297	.0288	.0288	.0288	.0290	.0289	.0280	.0270	.0264
50–54	.1010	.0493	.0471	.0422	.0393	.0319	.0296	.0282	.0278	.0288	.0330	.0353	.0350	.0334	.0308
55–59	.0782	.0414	.0451	.0422	.0414	.0411	.0422	.0410	.0389	.0357	.0298	.0250	.0218	.0192	.0166
60–64	.0645	.0400	.0463	.0438	.0420	.0350	.0319	.0312	.0312	.0311	.0300	.0278	.0247	.0214	.0179
65–69	.0608	.0329	.0418	.0406	.0402	.0362	.0354	.0342	.0337	.0339	.0346	.0356	.0365	.0374	.0379
70–99	.0631	.0428	.0503	.0498	.0491	.0505	.0495	.0486	.0479	.0477	.0468	.0471	.0474	.0477	.0479

TABLE 3—*Continued*

RAW SELECT LAPSE RATES—TERM LIFE INSURANCE

Age	Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2–4	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5–9	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10–14	.2500	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
15–19	.3012	.1094	.1100	.0655	.0705	.0582	.0455	.0583	.0335	.0606	.0396	.0222	.0000	.0278	.0000
20–24	.3168	.1481	.1230	.0995	.1103	.0606	.0575	.0497	.0598	.0571	.0427	.0318	.0252	.0244	.0294
25–29	.2389	.1352	.0999	.0839	.0915	.0569	.0493	.0435	.0510	.0602	.0569	.0327	.0441	.0203	.0519
30–34	.1998	.1230	.0906	.0724	.0790	.0526	.0505	.0502	.0444	.0546	.0419	.0247	.0375	.0234	.0123
35–39	.1768	.1089	.0900	.0607	.0610	.0478	.0425	.0435	.0410	.0447	.0486	.0287	.0310	.0324	.0143
40–44	.1630	.1082	.0734	.0643	.0555	.0449	.0493	.0454	.0455	.0470	.0444	.0281	.0343	.0270	.0312
45–49	.1571	.1042	.0680	.0650	.0552	.0504	.0419	.0488	.0535	.0471	.0431	.0505	.0643	.0456	.0385
50–54	.1647	.1176	.0628	.0733	.0592	.0844	.0683	.0703	.0526	.0782	.0714	.0423	.0614	.0261	.1481
55–59	.1730	.0835	.0697	.0686	.0658	.0830	.0687	.0618	.1128	.0667	.0000	.0000	.0000	.0000	.0000
60–64	.2000	.1074	.0421	.0515	.0806	.1379	.0000	.1429	.0000	.0000	.0000	.0000	.0000	.0000	.0000
65–69	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
70–99	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	Amount of Insurance														
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2–4	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5–9	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10–14	.1667	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
15–19	.2693	.1159	.1034	.0533	.0512	.0582	.0435	.0514	.0488	.0816	.0583	.0281	.0000	.0486	.0695
20–24	.2940	.1532	.1234	.0974	.0833	.0648	.0495	.0439	.0571	.0335	.0500	.0342	.0261	.0259	.0497
25–29	.2203	.1388	.1017	.0860	.0795	.0584	.0528	.0399	.0404	.0423	.0494	.0494	.0364	.0277	.0394
30–34	.1668	.1188	.0881	.0695	.0768	.0570	.0515	.0439	.0445	.0461	.0370	.0293	.0353	.0299	.0356
35–39	.1587	.0984	.0814	.0681	.0836	.0481	.0429	.0400	.0344	.0480	.0380	.0284	.0231	.0308	.0395
40–44	.1473	.0941	.0886	.0674	.0523	.0360	.0492	.0442	.0528	.0471	.0404	.0429	.0335	.0242	.0385
45–49	.1555	.1015	.0647	.0858	.0559	.0508	.0436	.0399	.0531	.0293	.0513	.0365	.0412	.0231	.0339
50–54	.1628	.1718	.0636	.0876	.0618	.1177	.0423	.0547	.1871	.0638	.0554	.0345	.0356	.0171	.0942
55–59	.1260	.0964	.0819	.0879	.0430	.1099	.1398	.0378	.0551	.0526	.0000	.0000	.0000	.0000	.0000
60–64	.2216	.1353	.0515	.0443	.0514	.1031	.0000	.0756	.0000	.0000	.0000	.0000	.0000	.0000	.0000
65–69	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
70–99	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

TABLE 3—*Continued*

GRADUATED SELECT LAPSE RATES—TERM LIFE INSURANCE

Age	Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.1330	.1051	.0731	.0591	.0508	.0417	.0373	.0341	.0318	.0298	.0214	.0183	.0149	.0131	.0127
1	.1771	.1108	.0796	.0643	.0532	.0412	.0359	.0330	.0319	.0305	.0212	.0179	.0144	.0127	.0129
2–4	.2201	.1162	.0757	.0581	.0500	.0413	.0370	.0342	.0325	.0313	.0236	.0204	.0172	.0166	.0201
5–9	.2184	.1179	.0710	.0511	.0439	.0381	.0350	.0335	.0338	.0354	.0334	.0364	.0353	.0353	.0485
10–14	.1746	.1045	.0543	.0388	.0383	.0391	.0421	.0437	.0451	.0472	.0491	.0444	.0375	.0372	.0392
15–19	.2864	.1345	.0878	.0684	.0715	.0611	.0548	.0496	.0469	.0462	.0449	.0415	.0360	.0335	.0317
20–24	.3198	.1513	.1231	.0968	.0867	.0647	.0570	.0517	.0486	.0460	.0411	.0342	.0272	.0248	.0244
25–29	.2371	.1289	.1047	.0847	.0757	.0580	.0525	.0496	.0489	.0486	.0463	.0395	.0319	.0286	.0239
30–34	.1990	.1220	.0907	.0749	.0689	.0554	.0512	.0480	.0460	.0447	.0418	.0376	.0315	.0248	.0188
35–39	.1797	.1122	.0831	.0688	.0619	.0500	.0459	.0430	.0417	.0414	.0392	.0364	.0306	.0244	.0197
40–44	.1634	.1101	.0751	.0630	.0574	.0482	.0454	.0436	.0435	.0433	.0416	.0383	.0333	.0283	.0264
45–49	.1615	.1070	.0756	.0660	.0612	.0510	.0481	.0475	.0469	.0485	.0504	.0490	.0458	.0437	.0502
50–54	.1660	.1042	.0754	.0698	.0696	.0600	.0595	.0585	.0584	.0577	.0602	.0518	.0430	.0477	.0506
55–59	.1617	.0984	.0705	.0692	.0741	.0699	.0725	.0703	.0659	.0585	.0471	.0334	.0262	.0258	.0249
60–64	.1365	.1124	.0918	.0825	.0786	.0597	.0533	.0486	.0441	.0385	.0279	.0212	.0173	.0167	.0163
65–69	.1323	.0990	.0714	.0656	.0641	.0546	.0508	.0452	.0388	.0331	.0226	.0191	.0190	.0163	.0153
70–99	.1749	.1257	.1044	.0850	.0717	.0550	.0504	.0464	.0413	.0353	.0239	.0180	.0138	.0117	.0117
	Amount of Insurance														
0	.1297	.0967	.0767	.0717	.0688	.0417	.0374	.0343	.0320	.0302	.0304	.0288	.0271	.0262	.0260
1	.1755	.1074	.0790	.0736	.0696	.0412	.0361	.0333	.0322	.0308	.0303	.0286	.0269	.0260	.0261
2–4	.2203	.1173	.0776	.0714	.0685	.0413	.0371	.0344	.0328	.0316	.0315	.0299	.0283	.0280	.0297
5–9	.2185	.1205	.0759	.0689	.0663	.0382	.0352	.0338	.0341	.0356	.0365	.0380	.0374	.0374	.0441
10–14	.1729	.0957	.0700	.0645	.0643	.0392	.0421	.0437	.0451	.0471	.0444	.0420	.0385	.0384	.0394
15–19	.2629	.1164	.0757	.0685	.0678	.0465	.0488	.0509	.0524	.0522	.0453	.0425	.0393	.0360	.0328
20–24	.2949	.1557	.0872	.0783	.0747	.0557	.0541	.0519	.0489	.0451	.0397	.0374	.0357	.0345	.0339
25–29	.2194	.1398	.0882	.0811	.0772	.0580	.0530	.0480	.0433	.0398	.0370	.0365	.0360	.0355	.0350
30–34	.1673	.1179	.0862	.0817	.0784	.0590	.0523	.0457	.0402	.0361	.0343	.0338	.0336	.0331	.0326
35–39	.1585	.0990	.0801	.0763	.0737	.0520	.0479	.0439	.0401	.0371	.0349	.0341	.0336	.0331	.0326
40–44	.1481	.0918	.0778	.0742	.0721	.0502	.0474	.0446	.0419	.0394	.0368	.0359	.0357	.0357	.0355
45–49	.1544	.1042	.0825	.0780	.0746	.0522	.0478	.0443	.0421	.0405	.0382	.0379	.0377	.0374	.0372
50–54	.1661	.1595	.1053	.0989	.0908	.0734	.0598	.0494	.0426	.0393	.0395	.0423	.0472	.0566	.0741
55–59	.1358	.1179	.0908	.0871	.0837	.0722	.0657	.0575	.0504	.0450	.0384	.0370	.0380	.0413	.0473
60–64	.1206	.0828	.0761	.0728	.0709	.0463	.0439	.0439	.0439	.0439	.0413	.0408	.0389	.0360	.0345
65–69	.1146	.0674	.0712	.0690	.0682	.0451	.0452	.0453	.0460	.0475	.0451	.0464	.0470	.0469	.0457
70–99	.1059	.1315	.1063	.1091	.1066	.1088	.0944	.0802	.0682	.0593	.0481	.0468	.0471	.0476	.0480

TABLE 4—TEST OF SELECT GRADUATION—LIMRA 1971-72 EXPECTED LAPSE RATES—PERMANENT LIFE INSURANCE

POLICY YEAR	EXPOSED TO RISK		ACTUAL LAPSES		EXPECTED LAPSES		RATIO ACTUAL/ EXPECTED		LAPSE RATE ACTUAL/ EXPOSED	
	Number	Amount ($000)	Number	Amount ($000)	Number	Amount ($000)	Number %	Amount %	Number %	Amount %
1	384,590	5,201,082	79,237	866,781	79,268	868,126	100.0	99.8	20.6	16.7
2	324,359	4,305,000	27,241	297,847	27,233	297,864	100.0	100.0	8.4	6.9
3	289,358	4,037,579	14,626	190,932	14,813	207,038	98.7	92.2	5.1	4.7
4	291,746	3,550,777	13,080	167,427	12,476	154,914	104.8	108.1	4.5	4.7
5	270,977	3,147,640	11.070	130,275	11,502	126,635	96,2	102.9	4.1	4.1
6	264,460	2,864,654	9,303	97,776	9,432	97,154	98.6	100.6	3.5	3.4
7	262,093	2,718,114	8,285	87,824	8,544	87,005	97.0	100.9	3.2	3.2
8	247,630	2,428,189	7,166	71,917	7,065	72,814	101.4	98.8	2.9	3.0
9	233,400	2,165,568	6,029	60,055	5,955	60,767	101.2	98.8	2.6	2.8
10	200,125	1,876,303	5,240	48,974	5,024	48,891	104.3	100.2	2.5	2.6
11	204,385	1,731,043	4,969	43,816	4,656	42,800	106.7	102.4	2.4	2.5
12	209,125	1,640,361	4,351	35,971	4,509	37,887	96.5	94.9	2.2	2.2
13	193,532	1,533,900	4,004	33,452	4,183	33,287	95,7	100.5	2.1	2.2
14	199,515	1,492,421	4,040	30,900	4,111	30,647	98.3	100.8	2.0	2.1
15	196,339	1,269,216	4,058	25,608	3,967	25,124	102.3	101.9	2.1	2.0
1–15	3,772,499	39,961,846	202,699	2,189,555	202,737	2,190,951	100.0	99.9	5.4	5.5

SUMMARY OF LAPSE RATES (%)

AGE(S)	POLICY YEAR(S)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	11.3	10.5	5.3	5.1	3.4	3.3	2.0	2.0	1.3	1.4
1	15.1	14.6	5.5	5.0	3.7	3.6	2.0	1.8	1.1	1.2
2–4	19.1	16.8	6.9	5.8	3.5	3.2	1.9	1.7	1.6	1.7
5–9	19.1	14.2	7.1	5.7	3.0	2.8	1.9	1.9	3.1	2.8
10–14	14.4	10.6	5.7	4.4	2.4	1.9	2.8	2.1	3.8	2.9
15–19	21.5	21.4	8.7	8.2	4.5	4.1	4.2	3.7	3.3	3.1
20–24	27.2	26.1	11.6	10.8	5.8	5.7	3.7	3.6	2.5	2.4
25–29	22.6	19.1	9.3	7.7	4.8	4.8	3.1	3.2	2.1	2.1
30–34	19.7	14.5	7.9	6.1	4.5	4.6	2.9	2.9	1.9	1.8
35–39	17.3	12.4	6.8	5.5	4.5	4.6	2.5	2.8	1.8	2.0
40–44	14.4	9.8	5.8	4.6	4.0	3.9	2.5	3.0	1.8	2.1
45–49	12.8	9.1	5.1	4.5	4.0	4.2	2.4	2.7	2.2	2.9
50–54	11.4	10.2	4.8	4.5	3.9	4.4	2.7	2.8	3.1	3.2
55–59	10.1	7.8	4.7	4.4	4.1	4.6	3.6	3.4	2.4	2.3
60–64	8.3	6.2	7.6	5.8	4.2	3.1	2.8	3.6	1.9	2.6
65–69	8.1	5.3	5.5	5.3	3.7	2.8	2.2	3.8	2.1	3.7
70–99	10.9	4.0	13.0	11.3	1.8	4.6	3.3	4.0	1.3	2.2
0–99	20.6	16.7	8.4	6.9	4.6	4.6	3.0	3.0	2.2	2.2

SUMMARY OF LAPSE RATIOS (%)

AGE(S)	POLICY YEAR(S)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	101.2	105.3	95.1	101.0	95.2	87.9	99.2	96.5	108.1	97.3
1	99.8	91.5	88.7	88.4	97.5	95.6	99.7	94.0	94.8	80.5
2–4	99.9	99.0	100.8	95.3	99.0	83.2	95.3	108.6	105.5	129.9
5–9	99.9	99.2	101.7	107.1	93.5	79.6	96.7	106.5	106.0	95.2
10–14	99.8	97.0	105.7	130.7	89.9	63.4	100.8	96.0	107.0	98.9
15–19	100.0	100.7	103.7	96.3	102.1	90.2	102.5	107.1	95.5	109.9
20–24	100.0	100.1	99.6	102.3	100.3	108.7	100.1	102.7	97.8	101.4
25–29	100.0	99.6	100.2	97.2	98.9	101.1	100.8	105.8	99.7	109.0
30–34	99.9	99.9	99.9	98.4	100.4	101.5	100.8	99.4	99.7	96.2
35–39	99.9	100.3	97.6	98.4	103.5	101.1	98.4	97.0	99.4	95.6
40–44	99.8	99.4	99.5	102.3	99.7	93.9	99.1	98.5	99.0	93.7
45–49	99.7	99.1	98.1	100.3	103.2	98.6	95.6	91.5	99.0	103.2
50–54	99.7	100.7	101.7	91.5	101.0	101.8	98.0	96.8	101.6	95.6
55–59	99.6	99.3	102.2	106.7	99.2	106.1	102.4	84.2	93.7	96.8
60–64	99.6	96.8	115.9	145.3	84.4	70.8	108.0	113.1	109.4	104.9
65–69	99.5	88.0	108.1	161.8	91.3	69.4	95.6	108.9	115.6	101.5
70–99	99.6	63.6	158.8	263.6	33.6	92.0	140.2	82.4	97.0	46.9
0–99	100.0	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 4—*Continued*—TEST OF SELECT GRADUATION—LIMRA 1971-72 EXPECTED LAPSE RATES—TERM LIFE INSURANCE

Policy Year	Exposed to Risk		Actual Lapses		Expected Lapses		Ratio Actual/ Expected		Lapse Rate Actual/ Exposed	
	Number	Amount ($000)	Number	Amount ($000)	Number	Amount ($000)	Number %	Amount %	Number %	Amount %
1	57,651	1,787,969	12,504	328,558	12,501	328,512	100.0	100.0	21.7	18.4
2	43,764	1,271,266	5,379	149,868	5,377	149,848	100.0	100.0	12.3	11.8
3	36,202	1,005,146	3,315	89,267	3,353	84,869	98.9	105.2	9.2	8.9
4	33,383	821,282	2,476	62,343	2,534	65,184	97.7	95.6	7.4	7.6
5	18,325	475,472	1,341	34,396	1,245	36,147	107.7	95.2	7.3	7.2
6	18,571	395,169	1,006	21,534	1,024	21,983	98.2	98.0	5.4	5.4
7	17,126	347,245	846	17,083	870	17,679	97.3	96.6	4.9	4.9
8	14.140	272,020	678	11,523	676	12.560	100.3	91.7	4.8	4.2
9	10,282	202,012	493	10,006	477	8,491	103.4	117.8	4.8	5.0
10	3,930	101,328	205	4,495	179	3,925	114.6	114.5	5.2	4.4
11	6,062	110,376	287	4,689	262	3,994	109.7	117.4	4.7	4.2
12	5,921	96,235	180	3,441	230	3,417	78.3	100.7	3.0	3.6
13	5,710	89,269	218	2,855	187	3,136	116.5	91.0	3.8	3.2
14	5,482	80,299	149	2,243	154	2,795	97.0	80.3	2.7	2.8
15	937	29,176	28	1,146	24	998	115.9	114.9	3.0	3.9
1–15	277,486	7,084,264	29,105	743,445	29,091	743,537	100.0	100.0	10.5	10.5

SUMMARY OF LAPSE RATES (%)

Age(s)	Policy Year(s)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2–4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10–14	25.0	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15–19	30.1	26.9	10.9	11.6	8.6	7.4	5.0	5.2	2.5	3.9
20–24	31.7	29.4	14.8	15.3	11.2	10.7	5.7	5.3	3.1	3.7
25–29	23.9	22.0	13.5	13.9	9.2	9.2	5.1	4.9	4.0	4.1
30–34	20.0	16.7	12.3	11.9	8.1	7.9	5.0	5.0	3.1	3.3
35–39	17.7	15.9	10.9	9.8	7.2	7.7	4.4	4.3	3.5	3.1
40–44	16.3	14.7	10.8	9.4	6.6	7.3	4.6	4.4	3.4	3.6
45–49	15.7	15.5	10.4	10.1	6.4	6.9	4.8	4.6	5.0	3.9
50–54	16.5	16.3	11.8	17.2	6.6	7.2	7.1	9.1	5.6	4.0
55–59	17.3	12.6	8.3	9.6	6.8	7.5	7.9	9.6	0.0	0.0
60–64	20.0	22.2	10.7	13.5	5.5	4.8	7.5	4.8	0.0	0.0
65–69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70–99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0–99	21.7	18.4	12.3	11.8	8.1	8.1	5.0	4.9	3.6	3.5

SUMMARY OF LAPSE RATIOS (%)

Age(s)	Policy Year(s)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2–4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10–14	143.2	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15–19	105.2	102.4	81.3	99.5	110.8	103.6	93.7	105.5	63.2	94.6
20–24	99.1	99.7	97.9	98.4	104.0	130.4	100.2	100.1	98.1	99.1
25–29	100.8	100.4	104.9	99.3	100.5	109.8	96.7	96.3	108.3	114.6
30–34	100.4	99.7	100.8	100.8	101.5	95.3	99.6	100.6	93.4	98.9
35–39	98.4	100.1	97.1	99.4	99.2	99.7	97.3	92.8	106.4	91.8
40–44	99.8	99.5	98.2	102.5	99.1	97.5	102.5	95.6	95.7	99.9
45–49	97.3	100.7	97.4	97.4	92.9	87.4	99.0	97.2	105.8	102.0
50–54	99.2	98.0	112.8	107.7	91.5	72.4	120.3	138.5	109.2	87.8
55–59	107.0	92.7	84.8	81.7	96.2	85.0	112.9	151.8	0.0	0.0
60–64	146.5	183.7	95.6	163.4	64.8	65.5	141.4	107.6	0.0	0.0
65–69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70–99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0–99	100.0	100.0	100.0	100.0	100.0	99.9	100.1	100.0	100.6	100.2

TABLE 5

RAW SELECT LAPSE RATES—PENSION LIFE INSURANCE

AGE	POLICY YEAR														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.3333	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2–4	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.1250
5–9	.0000	.0000	.0000	.0000	.0833	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10–14	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.3333	.0000	.0000	.0000
15–19	.3922	.3333	.3103	.0833	.2000	.0000	.0000	.0000	.1250	.1111	.0000	.0000	.1250	.0000	.1667
20–24	.2297	.1454	.1199	.0882	.0600	.0426	.0677	.0386	.0769	.0588	.0435	.0259	.0222	.0235	.0423
25–29	.2189	.1057	.0943	.0809	.0775	.0764	.0821	.0573	.0532	.0640	.0560	.0691	.0558	.0569	.0466
30–34	.1905	.1512	.1551	.1392	.1497	.1464	.1576	.0447	.0520	.0551	.0626	.0572	.0430	.0441	.0503
35–39	.1713	.1440	.1541	.1332	.1419	.1374	.1288	.1262	.1308	.1543	.1746	.1546	.1789	.1581	.1495
40–44	.1613	.1221	.1221	.1124	.1262	.1195	.1109	.1143	.1176	.1129	.1352	.1223	.1815	.1462	.1225
45–49	.1578	.1206	.1174	.1105	.1236	.1188	.1007	.1052	.1142	.1139	.1441	.1136	.1936	.1645	.1571
50–54	.1521	.1019	.1021	.1068	.1079	.1110	.1048	.1136	.1226	.1600	.1742	.1437	.2439	.2669	.2623
55–59	.1399	.1127	.1123	.1168	.1229	.1582	.1455	.2023	.1436	.4366	.0207	.0235	.0263	.0333	.0000
60–64	.1490	.1126	.1326	.1254	.1894	.1585	.0784	.0909	.0986	.1053	.0455	.0323	.0000	.1111	.0000
65–69	.2083	.1190	.1061	.1351	.0294	.0357	.1250	.1429	.0000	.0000	.0000	.0000	.0000	.0000	.0000
70–99	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	Amount of Insurance														
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.6250	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2–4	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.1111
5–9	.0000	.0000	.0000	.0000	.0260	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10–14	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0833	.0000	.0000	.0000
15–19	.3285	.3489	.2612	.0642	.1188	.0000	.0000	.0000	.0594	.1572	.0000	.0000	.1146	.0000	.2213
20–24	.1939	.1585	.1194	.0981	.0707	.0304	.0678	.0347	.0455	.0640	.0339	.0140	.0203	.0335	.0357
25–29	.1497	.1048	.0887	.0821	.0640	.0671	.0854	.0557	.0514	.0630	.0665	.0557	.0442	.0507	.0690
30–34	.1193	.1527	.1590	.1285	.1328	.1340	.2322	.0471	.0580	.0465	.0576	.0502	.0382	.0424	.0469
35–39	.0926	.1088	.1235	.1022	.1027	.0987	.1162	.1100	.1079	.1260	.1577	.1276	.1460	.1298	.1373
40–44	.0820	.0894	.0945	.0870	.0901	.0755	.0790	.0711	.0754	.0674	.0941	.0633	.1194	.0764	.0740
45–49	.0847	.0826	.0839	.0718	.0832	.0657	.0679	.0657	.0634	.0721	.1017	.0768	.1299	.0710	.0885
50–54	.0745	.0686	.0801	.0796	.0672	.0812	.0877	.0662	.0999	.1111	.1106	.0972	.2001	.2627	.2583
55–59	.0661	.0758	.0951	.0989	.0734	.0923	.1042	.1415	.0788	.4884	.0206	.0183	.0348	.1446	.0000
60–64	.0776	.0799	.1090	.0997	.1294	.1907	.0599	.0712	.0457	.0884	.0258	.0066	.0000	.0232	.0000
65–69	.0274	.0843	.0950	.0431	.0073	.0058	.1296	.1232	.0000	.0000	.0000	.0000	.0000	.0000	.0000
70–99	.0000	.0000	.0000	.2659	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

TABLE 5—*Continued*

GRADUATED SELECT LAPSE RATES—PENSION LIFE INSURANCE

Age	Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.1520	.1410	.1250	.1160	.1110	.1090	.1070	.1060	.1080	.1110	.1140	.1170	.1190	.1200	.1200
1	.1540	.1390	.1270	.1200	.1170	.1150	.1140	.1130	.1150	.1170	.1190	.1210	.1230	.1230	.1220
2–4	.1520	.1370	.1250	.1180	.1140	.1120	.1100	.1100	.1110	.1130	.1160	.1190	.1220	.1240	.1260
5–9	.1540	.1440	.1260	.1160	.1120	.1100	.1090	.1090	.1110	.1140	.1180	.1200	.1210	.1200	.1160
10–14	.1520	.1430	.1250	.1150	.1100	.1070	.1060	.1060	.1080	.1120	.1170	.1200	.1240	.1250	.1250
15–19	.2590	.2160	.1660	.1340	.1170	.1070	.1000	.0960	.0990	.1060	.1150	.1220	.1270	.1270	.1240
20–24	.2260	.1460	.1140	.0920	.0800	.0720	.0660	.0630	.0630	.0670	.0720	.0770	.0810	.0820	.0820
25–29	.2180	.1060	.0930	.0850	.0790	.0750	.0720	.0690	.0680	.0680	.0680	.0670	.0660	.0630	.0600
30–34	.1900	.1500	.1550	.1510	.1400	.1270	.1150	.1030	.0890	.0750	.0620	.0520	.0450	.0440	.0460
35–39	.1710	.1480	.1430	.1400	.1380	.1370	.1370	.1380	.1400	.1430	.1470	.1520	.1580	.1650	.1730
40–44	.1610	.1230	.1200	.1180	.1170	.1170	.1170	.1190	.1210	.1240	.1270	.1320	.1370	.1430	.1490
45–49	.1580	.1210	.1180	.1150	.1130	.1120	.1130	.1150	.1180	.1220	.1290	.1370	.1460	.1590	.1730
50–54	.1520	.1020	.1050	.1060	.1060	.1080	.1120	.1200	.1290	.1400	.1550	.1740	.1970	.2250	.2580
55–59	.1400	.1140	.1100	.1170	.1320	.1470	.1580	.1660	.1740	.1800	.1800	.1720	.1560	.1290	.0920
60–64	.1490	.1140	.1320	.1400	.1400	.1360	.1320	.1270	.1200	.1120	.1040	.0990	.0970	.1000	.1070
65–69	.1770	.1310	.1200	.1120	.1080	.1050	.1040	.1040	.1050	.1080	.1120	.1170	.1210	.1260	.1300
70–99	.1430	.1340	.1250	.1190	.1160	.1140	.1130	.1130	.1150	.1170	.1200	.1230	.1260	.1280	.1300
	Amount of Insurance														
0	.1020	.1010	.1000	.0970	.0940	.0920	.0910	.0890	.0890	.0890	.0900	.0910	.0920	.0930	.0940
1	.1030	.1010	.0990	.0970	.0960	.0950	.0940	.0930	.0920	.0920	.0910	.0910	.0920	.0930	.0940
2–4	.1020	.1010	.0990	.0960	.0940	.0930	.0910	.0900	.0900	.0900	.0900	.0910	.0920	.0930	.0950
5–9	.1030	.1000	.0990	.0960	.0940	.0920	.0910	.0890	.0880	.0890	.0900	.0920	.0930	.0930	.0930
10–14	.1030	.1010	.0990	.0960	.0930	.0910	.0890	.0880	.0870	.0880	.0890	.0900	.0920	.0930	.0950
15–19	.1810	.1620	.1350	.1190	.1060	.0940	.0850	.0810	.0780	.0740	.0730	.0760	.0830	.0970	.1170
20–24	.1890	.1530	.1180	.0970	.0820	.0670	.0560	.0540	.0510	.0470	.0460	.0520	.0630	.0840	.1140
25–29	.1490	.1040	.0890	.0810	.0750	.0690	.0640	.0630	.0620	.0590	.0580	.0590	.0630	.0710	.0830
30–34	.1190	.1510	.1520	.1460	.1390	.1320	.1240	.1120	.1020	.0930	.0830	.0710	.0500	.0400	.0450
35–39	.0930	.1080	.1170	.1120	.1060	.1050	.1060	.1010	.1040	.1150	.1270	.1370	.1460	.1470	.1440
40–44	.0820	.0900	.0940	.0890	.0840	.0810	.0800	.0740	.0730	.0770	.0820	.0850	.0870	.0840	.0780
45–49	.0850	.0830	.0830	.0780	.0730	.0710	.0710	.0680	.0690	.0750	.0820	.0890	.0960	.0990	.1010
50–54	.0750	.0700	.0810	.0770	.0750	.0770	.0820	.0820	.0880	.1050	.1230	.1390	.1550	.1630	.1670
55–59	.0670	.0760	.0940	.0940	.0940	.0980	.1050	.1030	.1090	.1250	.1430	.1560	.1680	.1700	.1660
60–64	.0800	.0850	.1040	.1070	.1070	.1080	.1090	.1020	.0970	.0990	.0990	.0930	.0840	.0650	.0380
65–69	.0760	.0960	.0880	.0850	.0820	.0800	.0780	.0790	.0800	.0790	.0790	.0810	.0840	.0900	.0980
70–99	.0950	.1060	.1060	.1020	.0980	.0960	.0940	.0910	.0890	.0910	.0930	.0940	.0950	.0940	.0910

TABLE 6—TEST OF SELECT GRADUATION—LIMRA 1971–72 EXPECTED LAPSE RATES
PERMANENT PENSION LIFE INSURANCE

Policy Year	Exposed to Risk		Actual Lapses		Expected Lapses		Ratio Actual/ Expected		Lapse Rate Actual/ Exposed	
	Number	Amount ($000)	Number	Amount ($000)	Number	Amount ($000)	Number %	Amount %	Number %	Amount %
1	43,703	384,660	7,494	38,933	7,473	38,887	100.3	100.1	17.1	10.1
2	50,731	388,685	6,315	39,943	6,354	39,779	99.4	100.4	12.4	10.3
3	43,814	315,079	5,466	33,509	5,376	32,703	101.7	102.5	12.5	10.6
4	37,549	274,633	4,344	25,689	4,538	27,148	95.7	94.6	11.6	9.4
5	29,868	207,496	3,733	19,020	3,571	19,394	104.5	98.1	12.5	9.2
6	23,125	154,408	2,851	13,580	2,730	14,022	104.4	96.9	12.3	8.8
7	18,864	128,990	2,209	14,452	2,226	11,777	99.2	122.7	11.7	11.2
8	14,667	90,399	1,529	6,854	1,726	7,709	88.6	88.9	10.4	7.6
9	12,510	82,936	1,329	6,502	1,480	7,108	89.8	91.5	10.6	7.8
10	10,635	75,161	1,307	7,171	1,262	6,820	103.6	105.2	12.3	9.5
11	9,257	55,460	1,181	5,582	1,104	5,251	107.0	106.3	12.8	10.1
12	8,630	57,787	967	4,579	1,056	5,717	91.5	80.1	11.2	7.9
13	7,241	47,103	1,091	5,245	919	4,779	118.7	109.8	15.1	11.1
14	5,840	36,761	749	3,319	750	3,578	99.9	92.8	12.8	9.0
15	5,659	33,764	666	3,064	759	3,224	87.8	95.0	11.8	9.1
1–15	322,093	2,333,321	41,231	227,444	41,324	227,893	99.8	99.8	12.8	9.7

SUMMARY OF LAPSE RATES (%)

Age(s)	Policy Year(s)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	14.3	45.5	0.0	0.0
2–4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	3.1
5–9	0.0	0.0	0.0	0.0	6.7	2.3	0.0	0.0	0.0	0.0
10–14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	1.8
15–19	39.2	32.9	33.3	34.9	20.6	16.3	3.2	1.4	6.5	4.8
20–24	23.0	19.4	14.5	15.9	9.4	10.1	5.5	4.6	3.3	2.7
25–29	21.9	15.0	10.6	10.5	8.6	8.1	6.9	6.6	5.8	5.7
30–34	19.0	11.9	15.1	15.3	14.8	14.2	10.2	12.3	5.2	4.8
35–39	17.1	9.3	14.4	10.9	14.4	11.0	13.5	11.1	16.4	14.0
40–44	16.1	8.2	12.2	8.9	12.0	9.1	11.5	7.4	14.1	8.6
45–49	15.8	8.5	12.1	8.3	11.7	8.0	11.1	6.7	15.2	9.5
50–54	15.2	7.4	10.2	6.9	10.5	7.7	11.7	8.7	19.5	15.4
55–59	14.0	6.6	11.3	7.6	11.7	9.1	17.8	13.5	2.1	3.9
60–64	14.9	7.8	11.3	8.0	14.3	11.0	11.5	10.9	3.7	1.1
65–69	20.8	2.7	11.9	8.4	9.5	5.1	5.8	3.1	0.0	0.0
70–99	0.0	0.0	0.0	0.0	0.0	25.1	0.0	0.0	0.0	0.0
0–99	17.1	10.1	12.4	10.3	12.2	9.8	11.6	9.1	12.7	9.4

SUMMARY OF LAPSE RATIOS (%)

Age(s)	Policy Year(s)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	125.5	487.6	0.0	0.0
2–4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.0	33.7
5–9	0.0	0.0	0.0	0.0	59.1	24.8	0.0	0.0	0.0	0.0
10–14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.2	20.0
15–19	151.4	181.5	154.3	215.4	143.1	133.1	31.6	16.5	53.0	55.5
20–24	101.6	102.6	99.6	103.6	96.1	98.4	82.0	79.4	41.9	42.4
25–29	100.4	100.5	99.7	100.8	98.6	97.3	96.5	102.8	88.1	87.9
30–34	100.2	100.3	100.8	101.1	99.1	96.6	96.3	105.1	103.4	80.2
35–39	100.2	99.6	97.3	100.8	102.2	98.4	97.2	104.5	104.1	100.8
40–44	100.2	100.0	99.3	99.4	101.2	101.3	96.9	95.7	103.8	102.4
45–49	99.9	99.6	99.6	99.5	100.9	101.2	96.3	94.3	104.2	102.9
50–54	100.1	99.3	99.9	98.0	99.6	98.1	99.4	103.2	106.1	108.5
55–59	99.9	98.7	98.8	99.7	98.7	96.7	112.4	129.2	13.0	24.8
60–64	100.0	97.0	98.7	94.0	104.7	104.0	88.7	103.2	36.6	13.6
65–69	117.7	36.0	90.9	87.8	82.6	59.6	55.2	38.5	0.0	0.0
70–99	0.0	0.0	0.0	0.0	0.0	246.0	0.0	0.0	0.0	0.0
0–99	100.3	100.1	99.4	100.4	100.4	98.7	97.9	102.4	101.4	96.6

TABLE 7

RAW SELECT LAPSE RATES—HIGH EARLY-CASH-VALUE LIFE INSURANCE

AGE	POLICY YEAR														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2–4	.2500	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5–9	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10–14	.0714	.0000	.1429	.0000	.0000	.0000	.1429	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
15–19	.1333	.0333	.2400	.0000	.0000	.0588	.1538	.2000	.0556	.0357	.0000	.0588	.0000	.0000	.0000
20–24	.1996	.0784	.1020	.1010	.0573	.0486	.0932	.0682	.0404	.0400	.0135	.0357	.0222	.0208	.0714
25–29	.1304	.0962	.1171	.1059	.0843	.0865	.0664	.0437	.0490	.0504	.0392	.0299	.0331	.0132	.0577
30–34	.0876	.1003	.1190	.1045	.0862	.0861	.0588	.0549	.0439	.0357	.0217	.0423	.0271	.0292	.0422
35–39	.0777	.0711	.0916	.0928	.0836	.0788	.0665	.0390	.0304	.0349	.0366	.0261	.0269	.0205	.0495
40–44	.0659	.0809	.0810	.0898	.0935	.0902	.0636	.0462	.0317	.0308	.0221	.0316	.0316	.0379	.0330
45–49	.0646	.0620	.0474	.0891	.0699	.0514	.0278	.0299	.0391	.0364	.0249	.0437	.0465	.0366	.0226
50–54	.0593	.0752	.0712	.0552	.0677	.0265	.0321	.0391	.0201	.0202	.0352	.0217	.0583	.0466	.1159
55–59	.0619	.0867	.1275	.0388	.0435	.0326	.0286	.0811	.0308	.0732	.0385	.0526	.0538	.0734	.0000
60–64	.0690	.0492	.0208	.1026	.0370	.0800	.0625	.0000	.0455	.0312	.0385	.0588	.0588	.0690	.1250
65–69	.1000	.0000	.5000	.0000	.2000	.0000	.0000	.0000	.0000	.1000	.0000	.0000	.0000	.1667	.0000
70–99	.0000	.0000	.5000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	Amount of Insurance														
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2–4	.2128	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5–9	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10–14	.0500	.0000	.1129	.0000	.0000	.0000	.1000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
15–19	.1667	.0263	.2328	.0000	.0000	.0568	.1604	.1500	.0552	.0305	.0000	.0435	.0000	.0000	.0000
20–24	.1654	.0843	.0897	.1095	.0503	.0438	.0872	.0705	.0356	.0282	.0120	.0286	.0199	.0439	.0667
25–29	.1130	.0961	.1180	.1175	.0679	.0939	.0641	.0420	.0440	.0568	.0450	.0423	.0311	.0103	.0522
30–34	.0811	.1044	.1185	.1272	.1030	.0984	.0640	.0556	.0410	.0327	.0217	.0562	.0335	.0343	.0455
35–39	.0618	.0744	.1032	.0915	.0960	.0598	.0701	.0406	.0300	.0414	.0413	.0236	.0305	.0185	.0565
40–44	.0697	.0962	.0889	.0666	.1471	.1268	.0743	.0481	.0301	.0318	.0195	.0253	.0335	.0418	.0399
45–49	.0645	.0639	.0506	.0739	.0720	.0263	.0266	.0299	.0442	.0257	.0172	.0683	.0440	.0297	.0201
50–54	.0733	.0811	.0676	.0505	.1473	.0306	.0457	.0199	.0371	.0242	.0264	.0199	.0588	.0419	.1208
55–59	.0725	.0745	.1199	.0360	.0249	.0532	.0448	.0739	.0350	.0707	.0287	.0460	.1108	.0734	.0000
60–64	.0837	.0684	.0166	.1141	.0172	.1538	.0552	.0103	.0281	.0385	.0968	.0270	.0561	.0503	.0317
65–69	.1845	.0000	.7407	.0000	.1633	.0000	.0000	.0000	.0000	.0599	.0000	.0000	.0000	.7634	.0000
70–99	.0000	.0000	.6667	.0000	.0000	.0000	.1497	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

TABLE 7—*Continued*

GRADUATED SELECT LAPSE RATES—HIGH EARLY-CASH-VALUE INSURANCE

Age	Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of Policies														
0	.1020	.0830	.0980	.1010	.0880	.0710	.0570	.0460	.0390	.0340	.0330	.0330	.0320	.0320	.0450
1	.1030	.0840	.0980	.1010	.0880	.0710	.0570	.0460	.0390	.0340	.0330	.0330	.0320	.0320	.0450
2–4	.1070	.0840	.0970	.1010	.0880	.0710	.0570	.0460	.0390	.0340	.0330	.0330	.0320	.0320	.0450
5–9	.1020	.0820	.0970	.1010	.0880	.0710	.0570	.0460	.0390	.0340	.0330	.0330	.0320	.0320	.0450
10–14	.1000	.0800	.1020	.1000	.0870	.0700	.0560	.0460	.0380	.0340	.0330	.0330	.0320	.0320	.0440
15–19	.1080	.0770	.1180	.0990	.0870	.0700	.0560	.0460	.0390	.0350	.0330	.0330	.0320	.0330	.0440
20–24	.1880	.0790	.1010	.0960	.0840	.0680	.0550	.0450	.0380	.0340	.0330	.0330	.0320	.0320	.0440
25–29	.1290	.0950	.1150	.1060	.0920	.0740	.0590	.0480	.0400	.0360	.0340	.0340	.0330	.0340	.0460
30–34	.0890	.0990	.1160	.1060	.0920	.0730	.0580	.0460	.0380	.0340	.0320	.0320	.0310	.0320	.0450
35–39	.0800	.0730	.0920	.1000	.0870	.0690	.0540	.0430	.0360	.0320	.0300	.0300	.0290	.0300	.0420
40–44	.0700	.0810	.0840	.1020	.0880	.0710	.0560	.0460	.0380	.0340	.0320	.0320	.0320	.0320	.0440
45–49	.0710	.0670	.0600	.0850	.0760	.0630	.0520	.0440	.0390	.0360	.0350	.0350	.0340	.0340	.0430
50–54	.0700	.0780	.0800	.0780	.0700	.0590	.0500	.0440	.0390	.0370	.0360	.0360	.0350	.0350	.0430
55–59	.0800	.0850	.1120	.0790	.0710	.0600	.0520	.0450	.0410	.0380	.0370	.0370	.0370	.0370	.0440
60–64	.0900	.0750	.0790	.0980	.0860	.0700	.0560	.0460	.0390	.0350	.0340	.0340	.0330	.0330	.0450
65–69	.1030	.0740	.1130	.1000	.0870	.0700	.0560	.0460	.0390	.0350	.0330	.0330	.0330	.0330	.0450
70–99	.1020	.0820	.1030	.1000	.0870	.0700	.0560	.0460	.0390	.0340	.0330	.0330	.0320	.0320	.0440
	Amount of Insurance														
0	.0840	.0910	.0940	.0920	.0850	.0750	.0620	.0500	.0410	.0350	.0320	.0330	.0350	.0400	.0460
1	.0850	.0920	.0940	.0920	.0850	.0750	.0620	.0500	.0410	.0350	.0320	.0330	.0350	.0400	.0460
2–4	.0870	.0910	.0940	.0920	.0850	.0750	.0620	.0500	.0410	.0350	.0320	.0330	.0350	.0400	.0460
5–9	.0840	.0880	.0930	.0920	.0850	.0750	.0620	.0500	.0410	.0350	.0320	.0330	.0350	.0400	.0460
10–14	.0820	.0860	.0960	.0910	.0840	.0740	.0620	.0500	.0400	.0340	.0320	.0330	.0350	.0400	.0460
15–19	.1010	.0810	.1160	.0890	.0820	.0720	.0610	.0490	.0400	.0350	.0320	.0330	.0350	.0390	.0450
20–24	.1520	.0860	.0910	.0900	.0830	.0730	.0600	.0490	.0390	.0340	.0310	.0320	.0340	.0390	.0450
25–29	.1110	.0960	.1160	.0970	.0900	.0780	.0650	.0520	.0420	.0350	.0320	.0330	.0360	.0410	.0470
30–34	.0810	.1040	.1160	.1160	.1060	.0910	.0730	.0550	.0420	.0330	.0300	.0300	.0340	.0410	.0490
35–39	.0630	.0760	.1030	.0920	.0850	.0730	.0600	.0470	.0370	.0310	.0280	.0290	.0320	.0360	.0430
40–44	.0710	.0960	.0900	.0980	.0900	.0780	.0640	.0510	.0400	.0330	.0300	.0310	.0340	.0390	.0460
45–49	.0670	.0670	.0570	.0660	.0620	.0560	.0500	.0430	.0380	.0350	.0330	.0340	.0350	.0380	.0410
50–54	.0750	.0830	.0730	.0770	.0720	.0650	.0560	.0470	.0400	.0360	.0340	.0350	.0370	.0400	.0440
55–59	.0760	.0800	.1110	.0620	.0600	.0570	.0530	.0490	.0460	.0440	.0440	.0440	.0450	.0460	.0480
66–64	.0840	.0830	.0640	.0900	.0830	.0730	.0610	.0490	.0400	.0350	.0320	.0330	.0350	.0400	.0450
65–69	.0960	.0770	.1210	.0930	.0860	.0760	.0650	.0530	.0450	.0390	.0370	.0370	.0400	.0440	.0500
70–99	.0830	.0860	.1120	.0890	.0830	.0730	.0610	.0500	.0410	.0350	.0330	.0330	.0360	.0400	.0460

TABLE 8—TEST OF SELECT GRADUATION—LIMRA 1971–72 EXPECTED LAPSE RATES
PERMANENT HIGH EARLY-CASH-VALUE LIFE INSURANCE

POLICY YEAR	EXPOSED TO RISK		ACTUAL LAPSES		EXPECTED LAPSES		RATIO ACTUAL/EXPECTED		LAPSE RATE ACTUAL/EXPOSED	
	Number	Amount ($000)	Number	Amount ($000)	Number	Amount ($000)	Number %	Amount %	Number %	Amount %
1.....	8,733	400,283	901	34,295	910	33,997	99.0	100.9	10.3	8.6
2.....	7,361	339,648	618	29,594	627	30,139	98.6	98.2	8.4	8.7
3.....	5,057	256,310	496	25,188	496	25,062	100.1	100.5	9.8	9.8
4.....	3,262	168,425	304	15,144	324	15,637	93.9	96.8	9.3	9.0
5.....	2,792	133,170	224	12,510	242	11,636	92.5	107.5	8.0	9.4
6.....	2,835	131,095	211	9,856	198	9,736	106.7	101.2	7.4	7.5
7.....	2,359	96,928	139	5,916	131	5,998	106.0	98.6	5.9	6.1
8.....	2,314	98,562	107	4,279	105	4,893	101.9	87.4	4.6	4.3
9.....	2,605	110,348	97	3,985	99	4,409	97.7	90.4	3.7	3.6
10.....	2,781	114,641	103	4,219	96	3,870	107.5	109.0	3.7	3.7
11.....	2,460	93,895	71	2,673	80	2,922	88.2	91.5	2.9	2.8
12.....	2,042	80,781	70	3,161	67	2,571	104.9	122.9	3.4	3.9
13.....	4,599	175,017	155	6,776	146	6,045	106.0	112.1	3.4	3.9
14.....	3,333	122,371	102	4,353	108	4,788	94.5	90.9	3.1	3.6
15.....	1,007	36,711	47	1,722	44	1,662	106.5	103.6	4.7	4.7
1–15.	53,540	2,358,185	3,645	163,671	3,673	163,366	99.2	100.2	6.8	6.9

SUMMARY OF LAPSE RATES (%)

AGE(S)	POLICY YEAR(S)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2–4.....	25.0	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5–9.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10–14...	7.1	5.0	0.0	0.0	10.0	8.1	3.7	2.8	0.0	0.0
15–19...	13.3	16.7	3.3	2.6	11.3	10.0	8.8	8.0	1.2	1.0
20–24...	20.0	16.5	7.8	8.4	9.1	8.7	5.8	5.2	2.4	2.8
25–29	13.0	11.3	9.6	9.6	10.6	10.3	6.2	6.4	3.1	3.2
30–34...	8.8	8.1	10.0	10.4	10.6	11.7	5.6	5.8	3.0	3.6
35–39...	7.8	6.2	7.1	7.4	9.0	9.8	4.9	4.8	2.8	3.0
40–44...	6.6	7.0	8.1	9.6	8.7	9.3	5.1	6.1	3.1	3.2
45–49...	6.5	6.5	6.2	6.4	6.5	6.2	3.7	3.0	3.8	3.8
50–54...	5.9	7.3	7.5	8.1	6.6	7.8	2.7	3.1	5.0	4.6
55–59...	6.2	7.3	8.7	7.5	8.1	6.8	5.0	5.5	5.2	6.8
60–64...	6.9	8.4	4.9	6.8	5.3	4.7	3.8	4.2	6.6	5.1
65–69...	10.0	18.5	0.0	0.0	22.2	22.3	5.0	2.9	4.3	36.7
70–99...	0.0	0.0	0.0	0.0	20.0	13.7	0.0	9.9	0.0	0.0
0–99	10.3	8.6	8.4	8.7	9.2	9.5	5.1	5.1	3.3	3.7

SUMMARY OF LAPSE RATIOS (%)

AGE(S)	POLICY YEAR(S)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2–4.....	233.6	244.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5–9.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10–14...	71.4	61.0	0.0	0.0	100.6	86.3	75.3	55.4	0.0	0.0
15–19...	123.5	165.0	43.3	32.5	108.0	101.1	186.5	153.2	35.8	29.3
20–24...	106.2	108.8	99.2	98.0	95.3	98.3	112.6	94.3	73.2	79.6
25–29...	101.0	101.8	101.2	100.1	99.1	99.7	114.8	111.3	88.7	88.2
30–34...	98.4	100.1	101.3	100.4	99.5	103.2	112.4	99.9	91.8	102.1
35–39...	97.1	98.2	97.3	97.9	96.7	102.7	106.1	96.4	93.3	92.6
40–44...	94.1	98.1	99.9	100.2	95.8	100.5	106.5	117.0	95.5	91.6
45–49...	91.0	96.3	92.5	95.4	91.4	102.6	79.7	65.2	108.2	106.6
50–54...	84.8	97.8	96.4	97.7	85.1	104.8	59.2	63.7	138.1	124.6
55–59...	77.3	95.5	102.0	93.2	87.5	83.5	104.0	110.4	139.5	151.5
60–64...	76.6	99.6	65.6	82.4	60.4	61.1	80.2	86.1	187.7	135.7
65–69...	97.1	192.2	0.0	0.0	220.6	228.3	108.8	56.6	131.8	896.9
70–99...	0.0	0.0	0.0	0.0	202.8	146.5	0.0	162.7	0.0	0.0
0–99	99.0	100.9	98.6	98.2	96.5	101.0	104.4	97.7	99.9	103.9

TABLE 9—TEST OF SELECT GRADUATION—LIMRA 1971–72 EXPECTED LAPSE RATES
RESTRICTED SAMPLE

POLICY YEAR	EXPOSED TO RISK		ACTUAL LAPSES		EXPECTED LAPSES		RATIO ACTUAL/EXPECTED		LAPSE RATE ACTUAL/EXPOSED	
	Number	Amount ($000)	Number	Amount ($000)	Number	Amount ($000)	Number %	Amount %	Number %	Amount %
1	496,060	7,789,546	100,512	1,272,097	100,421	1,271,471	100.1	100.0	20.3	16.3
2	427,267	6,317,651	39,855	519,802	39,728	519,056	100.3	100.1	9.3	8.2
3	375,237	5,623,238	24,065	340,525	24,134	350,645	99.7	97.1	6.4	6.1
4	366,458	4,821,237	20,265	271,302	19,929	263,499	101.7	103.0	5.5	5.6
5	321,990	3,964,901	16,370	196,241	16,563	193,925	98.8	101.2	5.1	4.9
6	309,379	3,548,886	13,399	142,930	13,425	143,205	99.8	99.8	4.3	4.0
7	300,855	3,295,001	11,496	125,397	11,812	122,777	97.3	102.1	3.8	3.8
8	279,054	2,891,672	9,499	94,728	9,603	98,184	98.9	96.5	3.4	3.3
9	259,045	2,563,427	7,958	80,629	8,035	80,986	99.0	99.6	3.1	3.1
10	226,475	2,167,572	6,855	64,865	6,561	63,517	104.5	102.1	3.0	3.0
11	222,345	1,992,128	6,516	56,862	6,119	55,077	106.5	103.2	2.9	2.9
12	217,737	1,876,544	5,578	47,206	5,878	49,717	94.9	94.9	2.6	2.5
13	211,310	1,847,044	5,474	48,354	5,459	47,403	100.3	102.0	2.6	2.6
14	214,352	1,733,285	5,047	40,850	5,142	41,921	98.2	97.4	2.4	2.4
15	203,942	1,368,907	4,799	31,539	4,794	31,011	100.1	101.7	2.4	2.3
1–15	4,431,506	51,801,040	277,688	3,333,327	277,604	3,332,393	100.0	100.0	6.3	6.4

SUMMARY OF LAPSE RATES (%)

AGE(S)	POLICY YEAR(S)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	11.3	10.5	5.3	5.1	3.4	3.3	2.0	2.0	1.3	1.4
1	15.1	14.6	5.5	5.0	3.7	3.6	2.0	1.8	1.1	1.2
2–4	19.1	16.8	6.9	5.8	3.5	3.2	1.9	1.7	1.6	1.7
5–9	19.1	14.1	7.1	5.6	3.0	2.8	1.9	1.9	3.1	2.8
10–14	14.4	10.6	5.7	4.4	2.4	1.9	2.8	2.1	3.8	2.9
15–19	21.9	21.7	8.9	8.4	4.6	4.2	4.3	3.8	3.2	3.1
20–24	27.4	26.2	11.9	11.3	6.1	6.2	3.8	3.7	2.5	2.4
25–29	22.6	19.3	10.0	9.3	5.6	5.9	3.4	3.6	2.2	2.3
30–34	19.4	14.7	9.7	8.6	6.2	6.2	3.6	3.7	2.1	2.1
35–39	17.1	12.9	8.9	7.3	6.4	6.0	3.8	3.5	2.9	2.6
40–44	14.8	11.0	8.1	6.5	6.0	5.2	3.8	3.6	3.0	2.5
45–49	13.8	10.4	7.9	6.2	6.3	5.1	3.9	3.2	3.9	3.4
50–54	13.1	10.8	7.5	7.0	6.3	5.3	4.6	3.8	5.0	4.1
55–59	12.0	8.2	7.9	5.7	7.1	5.6	6.2	4.6	2.5	3.0
60–64	11.1	7.5	9.0	6.5	7.0	4.2	3.6	4.1	2.1	2.9
65–69	9.0	6.1	5.7	4.9	4.3	3.6	2.3	3.7	2.1	7.5
70–99	10.3	3.7	12.3	9.4	2.0	6.4	3.2	4.2	1.3	2.2
0–99	20.3	16.3	9.3	8.2	5.7	5.6	3.6	3.5	2.6	2.5

SUMMARY OF LAPSE RATIOS (%)

AGE(S)	POLICY YEAR(S)									
	1		2		3–5		6–10		11–15	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount
0	101.1	105.2	95.0	100.8	95.1	87.9	99.0	96.4	107.8	97.2
1	99.8	91.5	88.7	88.4	97.4	95.5	99.8	94.6	94.4	80.3
2–4	99.9	99.1	100.7	95.1	98.8	83.1	95.1	108.3	105.1	129.6
5–9	99.9	99.1	101.6	106.4	93.4	79.4	96.3	106.3	105.8	95.2
10–14	99.8	96.9	105.5	129.2	89.8	63.5	100.4	95.4	106.9	98.7
15–19	100.4	101.1	102.7	96.6	102.5	90.9	102.4	107.2	95.2	109.0
20–24	100.0	100.2	99.8	101.9	100.7	110.9	99.9	102.1	96.9	100.3
25–29	100.2	100.0	101.5	98.5	99.4	103.3	100.4	104.5	99.2	107.2
30–34	100.2	100.0	100.6	100.0	100.2	99.1	100.0	100.2	99.4	95.8
35–39	99.7	100.1	97.9	99.3	102.2	100.5	97.7	97.0	100.9	95.8
40–44	99.9	99.6	99.8	101.8	100.3	96.4	98.5	99.0	100.3	94.9
45–49	99.6	99.8	99.5	98.9	100.9	96.6	95.5	90.5	101.7	103.6
50–54	100.2	100.7	103.1	98.6	99.4	95.4	99.2	101.4	104.4	100.9
55–59	100.5	98.1	99.9	98.5	98.8	99.4	107.3	97.9	80.1	99.5
60–64	102.4	105.8	107.1	125.1	93.4	77.7	101.6	108.1	105.3	104.9
65–69	101.4	95.1	100.3	129.8	92.3	79.5	90.7	100.3	107.3	196.5
70–99	93.3	56.2	148.8	185.8	36.7	111.9	134.4	83.0	97.0	46.9
0–99	100.1	100.0	100.3	100.1	100.1	100.0	99.5	100.0	100.1	99.9

APPENDIX I

INSTRUCTIONS FOR ANNUAL STUDY OF LAPSATION UNDER STANDARD ORDINARY ISSUES EXPERIENCE BETWEEN 1971 AND 1972 ANNIVERSARIES

This year the annual study of lapsation on standard ordinary insurance covers the experience between 1971 and 1972 anniversaries. The study is to be carried out on a fifteen-year select and ultimate basis, by amounts of insurance and (optionally) by number of policies in accordance with the following instructions.

The format of this study is similar to that of the Society of Actuaries' annual mortality study. This approach should minimize the work of compiling the contribution to the lapse study. This study does not require any computation of expected lapses. If contributors so wish, LIMRA will calculate the expected lapses, using a standard table such as Linton A or Moorhead S. Please indicate your preference in the letter of transmittal.

I. General instructions.

A. Lapsation is to mean termination by lapse, surrender, or application of reduced paid-up or extended term insurance options, but not automatic premium loan, expiry, or maturity. If companies are in a position to do so, they should not consider termination of term insurance due to conversion as lapsation.

B. The data to be submitted will consist of two parts:

1. Recent issues (policy years 1–15) on a select basis.
2. Policy years 16 and later, on an ultimate basis.

Age is defined to be the age at issue for the select contribution and the attained age on the 1971 anniversary for the ultimate contribution.

If your company has changed to the age-last-birthday basis, please indicate in your letter of transmittal which years of issue are on this basis. Data for age nearest birthday and age last birthday may be combined.

C. The following classes of policies should be excluded. If it is not feasible to do so, please indicate in the letter of transmittal which of them have been included.

1. Policies not subject to the company's usual underwriting standards, for example:
   a) Group conversions.
   b) Term conversions and renewals—consider as issued on issue date of original term policy. If they cannot be treated in this manner, these policies should be excluded.
   c) Family policy conversions on dependents.
   d) Policies issued as a result of an option under a guaranteed insurability rider.

e) Policies issued on a "guaranteed issue" basis (such as certain pension trust business) unless handled in accordance with item 4 below.

f) Policies subject to simplified underwriting or issued up to a mortality limit higher than is customarily used by the company for standard ordinary insurance.

2. Substandard policies.
3. Policies in force under extended term insurance or reduced paid-up provisions.
4. Experience on wives and children insured under family policies.
5. Joint life policies.
6. Reinsurance assumed.
7. Policies issued in Canada (if possible). Reinsurance ceded should be included.

D. The value of the study will be increased if the data are submitted with various subdivisions. Items 1–3 below constitute the main subdivisions of the experience control number of the Society of Actuaries' mortality study. Items 4–7 were indicated as desirable and available within up to four years by the majority of companies polled in the recent survey. If you are concerned about the number of subdivisions, we recommend that items 1–3 be eliminated.

1. Divide the experience by type of underwriting: medical, nonmedical, or special.
2. Divide the experience by sex of the insured.
3. Divide the experience into premium-paying policies and policies paid up by their terms.
4. Divide the experience by whether the insurance is participating or nonparticipating.
5. Divide the experience into permanent insurance and term insurance.
6. Submit the experience of pension business on separate summary cards. A convenient definition of pension business would be qualified plan business of all types.
7. Submit the experience of insurance that has high early cash values or that is otherwise designed to be sold on a minimum deposit basis on separate summary cards.

If you cannot furnish the data with the above divisions, your contribution should be submitted without that division (i.e., combined data). Please indicate in the letter of transmittal the divisions actually used.

E. The recommended practice for certain policies is indicated below. Please describe in the letter of transmittal any variation from this recommended practice.

1. Policy changes are not to be considered lapses. Partial surrenders are to be considered lapses for the amount reduced, but not policy lapses.
2. Policies for increasing or decreasing amounts, for example, family income policies:

a) The amounts appearing in exposures and lapses must be consistent.
b) An equivalent level amount may be used in both cases.
c) Policies with graded death benefits to juveniles should be included for full face amount in both exposures and lapses.

II. Instructions for completion of summary cards for exposures and actual lapses.

A. Select experience (policy years 1–15).

A separate set of summary cards should be submitted for each class of data possible for each company. The data for each of these classes should include the exposure and actual lapses by amounts of insurance and/or number of policies on issues of 1957–71, observed between 1971 and 1972 policy anniversaries.

The data should be reported in the following issue-age groups:

0	20–24	50–54
1	25–29	55–59
2–4	30–34	60–64
5–9	35–39	65–69
10–14	40–44	70 and over
15–19	45–49	

IBM cards, completed in accordance with the instructions that follow, should be used for transmitting the data.

B. Ultimate experience (policy years 16 and later).

A separate set of summary cards should be submitted for each class of data possible for each company.

This year's contribution should cover exposures and actual lapses by amounts of insurance and/or policies on issues of 1956 and earlier, observed between 1971 and 1972 policy anniversaries. Data should be reported for attained ages 15–95, on an individual attained-age basis.

The work of compiling the data will be simplified greatly if each company *reviews* its contribution *carefully* before submitting it, making sure that all fields in the transmittal cards are punched according to *the specifications* given. Also, please be sure that the transmittal cards balance with the check totals requested.

The letter of transmittal should be accompanied by totals of exposures and actual lapses, separately for each subdivision your company makes.

In the recent-issues data, the following check totals should be shown:

1. For each duration–all ages combined.
2. For each age group—all durations combined.
3. Grand totals for all ages and durations combined.

In the ultimate data, the check totals should be shown as follows:

1. For attained-age groups 15–19, 20–29, 30–39, and so on.
2. Grand totals for all ages combined.

(Note: Instructions for completion of summary cards for exposures and actual lapses are reproduced on p. 290).

INSTRUCTIONS FOR COMPLETION OF SUMMARY CARDS FOR EXPOSURES AND ACTUAL LAPSES (ANY IBM CARD FORM)

Columns	Item	Instructions
1–3.....	Company code number	Your company code number is ————.
4–7.....	Age	Where age groups at issue are used (recent issues), punch the lowest age in cols. 4–5 and the highest age in cols. 6–7. For age group 70 and over, punch 70 in cols. 4–5 and XX (numeric) in 6–7. Where individual ages at issue are used, punch the individual age both in cols. 4–5 and 6–7. For individual attained age (ultimate data) punch XX (numeric) in cols. 4–5 and the attained age in cols. 6–7.
8–9.....	Duration	Punch the appropriate policy year (01–15) for durations 1–15. Leave blank for ultimate data
10.....	Age basis	0 = Age nearest birthday; 1 = Age last birthday; 2 = Age next birthday; 3 = Combined.
11.....	Sex	1 = Males; 2 = Females; 0 = Not subdivided.
12.....	Medical basis	1 = Medical; 2 = Nonmedical; 3 = Lay or paramedical; 0 = Not subdivided.
13.....	Participation code	1 = Participating; 2 = Nonparticipating; 0 = Not subdivided
14.....	Type of insurance	1 = Permanent; 2 = Term; 0 = Not subdivided.
15.....	Pension code	1 = Pension; 2 = All other; 0 = Not subdivided.
16.....	High early-cash-value code	1 = High early-cash-value (minimum deposit); 2 = All others; 0 = Not subdivided.
17.....	Premium-paying status	1 = Premium-paying; 2 = Fully paid-up; 0 = Not subdivided.
18–19...	Policy anniversary	Punch the last two digits of the calendar year in which the policy year of observation terminates.
20.....	Not used	
21–27...	Exposed (policies)	Punch number of policies; if not available, leave blank.
28–39...	Exposed (amounts)	Punch amount to the nearer $1. If a company summarizes in units greater than $1, fill in any zeros required to maintain alignment of the decimal place.
40–45...	Lapses (policies)	Punch the number of policies terminated by lapsation; if not available, leave blank.
46–55...	Lapses (amounts)	See instructions for cols. 28–39.
56–80...	Not used	

DISCUSSION OF PRECEDING PAPER

ROBERT P. COATES:

We owe Mr. Brzezinski and the LIMRA organization a debt of gratitude for this valuable paper. These tables provide valuable reference points for future studies and for individual companies in considering their own experience. This discussion deals largely with some relatively minor points on which I would find further comment by the author helpful.

The paper stimulated me to refer back to the papers by Mr. Linton and Mr. Moorhead. In the early part of his paper Mr. Moorhead discussed in some detail the two possible ways of classifying terminations that occur on the policy anniversary. One may associate them with the previous policy year, as was done by Mr. Linton and is, I believe, the more usual practice, or with the following policy year, as was done by Mr. Moorhead. I could not find a specification of this point in Mr. Brzezinski's paper or in the appendix which gave the instructions to the contributing companies. The impact on the level of termination rates, especially the first-year rate, can be significant, and I would suggest that this point be clarified in relation to the data in the paper and in instructions for future LIMRA studies.

From the discussion on selection of data in the introductory section of the paper, I concluded that nonrenewal of a renewable term policy was not counted as a lapse. Much of the term insurance issued today is on a renewable basis and contemplates the possibility of a long period of term insurance coverage, up to age 65 or even somewhat beyond. Under these circumstances failure to renew the policy seems to me to be closely akin to lapsation of a regular permanent insurance policy, although one could expect a somewhat higher rate of termination at renewal points as a reaction to the premium increase required for renewal. Rates treating nonrenewal as a lapse or, even better, showing it as a separate component of a total termination rate would be helpful if they can be made available.

The consideration of nonrenewal of term insurance as related to lapses raised in my mind the difficulty caused by the use of the term "lapse" to cover the whole range of terminations of insurance. For one thing, it does not agree with the nomenclature of the NAIC Policy Exhibit, which distinguishes lapses and surrenders and handles changes to nonforfeiture benefits generally as decreases in face amount. Furthermore, the terminations that occur around the retirement ages are completely different in

motivation and purpose from the failures to pay premiums at an early duration. I have no simple suggestion for an alternate term, although perhaps "voluntary termination rate" might be an improvement.

Other data developed by LIMRA indicate considerable variation in termination rates among companies. The annual reports of the Mortality Committee on Ordinary Insurance and Annuities include two tables (pp. 12 and 16 of *TSA, 1973 Reports*) that indicate in a general way the extent of company variations. It would be helpful if something of this sort could be added to the analysis of the LIMRA lapse study. A separation of first-year and later-year termination rates would be of interest in this regard.

There is a question in my mind of the utility of quoting lapse rates for pension insurance and term insurance at the extremely low and high issue ages, where few if any policies are issued. As stated in the paper, these rates have had to be constructed by extrapolation and are essentially arbitrary.

In closing, I would like to reiterate my feeling that this paper is a very useful one and will stand as a basic contribution to the literature.

NATHAN H. EPSTEIN:

Mr. Brzezinski's paper is of landmark significance. The tables presented in this paper are based on the largest body of data on persistency yet to be published in actuarial literature. In giving them to us, Mr. Brzezinski has performed an invaluable service for the actuarial profession. I shall limit my comments to two specific areas: (1) the technical aspects of the paper and (2) factors affecting persistency.

Technical Considerations

I believe that the paper would be greatly enhanced by a detailed technical memorandum. I would like to have the following points covered:

1. The source of the data: What are the characteristics of the contributing companies?
   a) New or old?
   b) Large or small?
   c) Participating or nonparticipating?
   d) General agency, branch office, or brokerage?
2. The quality of the data: What steps were taken to assure a high degree of "purity?"
3. The characteristics of the data: Did the data exhibit any special qualities that would enable us to construct a lapse function that would have a desirable mathematical property such as convexity? Many actuarial problems in com-

pound interest can be solved quickly because the interest function is convex and the powerful Jensen's inequality can be used.

4. The construction of the table: How were the tables constructed? Were tests done using graduation methods other than the Whittaker-Henderson Type B, since the latter introduces some systematic deviations? What was the semi-Bayesian method used for the pension and high early-cash-value data?
5. Statistical tests: What statistical tests were made on the difference between actual and expected values?
6. Computational problems: Were there any computer problems? Was any analysis of errors made?

Factors Affecting Lapse

Studies of the various factors affecting lapse have appeared in the literature. I append a short Bibliographic Note listing the classic papers. The various factors affecting lapse on which we have published actuarial studies can be summarized as follows:

1. Characteristics of the insured
   a) Income
   b) Age
   c) Occupation
   d) Sex
   e) Previous ownership of the company's policy
2. Characteristics of the policy
   a) Mode and settlement of first premium
   b) Plan of insurance
   c) Amount of premium
   d) Amount of policy
3. Characteristics of agent and sale
   a) Status of agent: full time, part time, broker
   b) By contract year: new versus mature agets
   c) Type of sale: "package" versus need
4. Economic factors
   a) Variation by calendar year: effect of general economy
   b) Policies with and without loans
   c) Geographic area
   d) Urban versus rural
5. Underwriting factors
   a) Standard versus substandard
   b) Medical versus nonmedical
   c) Policies with income disability

I pose three questions: (1) Have the new data produced any different results as to the impact of each of the above factors on the lapse rate? (2) Have new factors been revealed by the data? (3) Since many factors

that affect lapse are operating simultaneously, which ones are dominant and which recessive?

I believe Mr. Brzezinski to be in an excellent position to give us a "theory of lapse."

Conclusion

The lapse rate is a major actuarial function. Others besides actuaries have become interested in this aspect of the actuary's work. The lapse assumption used in GAAP work is of interest to the accounting profession and the Securities and Exchange Commission. Lapse assumptions and turnover rates assume new importance in pension programs now that we have the Employee Retirement Income Security Act. In addition, others in top management of life companies are requiring more and more management information, corporate models, and corporate projections that are dependent on lapse rates.

It is important that we as actuaries have a thorough understanding of the data underlying the lapse rates, the way our tables are constructed, the factors affecting lapse, and the uses and misuses of this material. We must also be able to communicate this expertise to an ever expanding audience.

Furthermore, I believe it should be actuaries who have the final say in the matter of lapse. It is therefore gratifying to me that we can see the LIMRA material exposed to actuarial scrutiny in the pages of the *Transactions* and that we have so able a colleague as Mr. Brzezinski so intimately involved in the entire research program. (Indeed, every table and every statistical study used by actuaries should receive actuarial scrutiny, either through the medium of a paper in the *Transactions* or through a Society of Actuaries committee.)

Mr. Brzezinski has done a yeoman's job for us. I hope he will persist in his lapse work and not withdraw his attention or discontinue his efforts, and that little time will elapse before his next paper.

BIBLIOGRAPHIC NOTE

The actuarial literature on persistency falls into two major categories: (1) technical papers on the construction and use of lapse rates and (2) "theory of lapse" papers that present studies of the various factors affecting lapse.

Classic Technical Papers:

LINTON, M. A. "Returns under Agency Contracts," *RAIA*, XIII, 283.

MOORHEAD, E. J. "The Construction of Persistency Tables," *TSA*, XII, 64.

PAPPS, P. C. H. "A Method of Estimating the Rate of Persistency," *RAIA*, VIII, 13.

Classic "Theory of Lapse" Papers:

BOWERMAN, W. G. "Withdrawal Rates and Influences Affecting Them," *RAIA*, XVII, 5.

BUCK, NORMAN F. "First Year Lapse and Default Rates," *TSA*, XII, 258.

CANNON, G. E. "A Study of Persistency," *RAIA*, XXXVII, 267.

MACLEAN, A. T. "Comparative Rates of Withdrawal," *TASA*, XXI, 64.

MARTIN, L. R. "Withdrawal Rates in the Connecticut Mutual," *TASA*, XXXVIII, 475.

RICHARDSON, C. F. B., AND HARTWELL, JOHN M. "Lapse Rates," *TSA*, III, 338.

GORDON H. LEAVITT:

Just as mortality depends on policy underwriting, lapse rates depend on the way in which policies are sold. It has been apparent for years that lapse rates in savings bank life insurance (SBLI), sold over the counter in

TABLE 1

LAPSE RATES—BY NUMBER OF POLICIES

Policy Year	New York SBLI, 1974					LIMRA, 1971–72	
	Life	Endowment	5-Year Term	Decreasing Term	All Policies	Permanent	Term
1.....	7.8%	6.2%	7.9%	6.2%	7.6%	20.6%	21.7%
2.....	2.5	3.4	5.0	4.6	3.7	8.4	12.3
3.....	2.2	3.0	3.4	3.8	2.8	5.1	9.2
4.....	2.3	4.1	3.9	4.6	3.4	4.5	7.4
5.....	2.3	3.2	6.3	3.2	3.6	4.1	7.3

New York, Massachusetts, and Connecticut, are substantially lower than in agent-sold life insurance, but Mr. Brzezinski's table and a recent study of New York SBLI lapse rates for the first five policy years permit a more precise comparison (see Table 1 of this discussion).

By far the most sensitive parameter of the SBLI study is frequency of premium payment. First-year lapse rates by method of payment areas follows: annual, 3.1 per cent; semiannual, 3.7 per cent; quarterly, 9.0 per cent; and monthly, 18.4 per cent.

It is interesting to note that the banks that sell insurance more aggressively (which are more likely to hire former company agents as salesmen) tend to have higher lapse rates. Six aggressive banks that sell a large proportion of the total SBLI business had a combined first-year lapse rate of 10.1 per cent, compared with a rate of 4.1 per cent for six "nonaggressive" banks. Also, New York metropolitan area banks generally have higher lapse rates than upstate banks.

I wonder whether Mr. Brzezinski would care to discuss why frequency of premium payment was not included as a factor in the LIMRA study.

STEPHEN T. MC ELHANEY:

The LIMRA 1971–72 expected lapse tables are a welcome addition to actuarial literature. I am sure that many actuaries have had difficulty in deciding what lapse rates should be used in asset shares, model offices, gross premium calculations, and studies of projected agency earnings.

TABLE 1

COMPARISON OF LIMRA, MOORHEAD, AND LINTON TABLES

Duration	LIMRA 1971–72 Permanent Select Rates by Amount (Raw Rates, All Ages)	Moorhead Table S	Linton Table A
1	.167	.1250	.100
2	.069	.1000	.060
3	.047	.0450	.050
4	.047	.0350	.044
5	.041	.0300	.040
6	.034	.0275	.036
7	.032	.0260	.032
8	.030	.0250	.029
9	.028	.0245	.027
10	.026	.0240	.025
11	.025	.0235	.024
12	.022	.0230	.023
13	.022	.0225	.022
14	.021	.0220	.021
15	.020	.0215	.020

These tables should be useful even to companies that have developed their own lapse rate tables, since these companies now have a basis of comparison with the rest of the industry.

The LIMRA tables should eventually become the new standard, thus replacing the Moorhead and Linton tables. Just as mortality tables become outdated and replaced, we should be sure that our lapse rate tables are updated periodically on the basis of recent experience. It is instructive to compare the LIMRA permanent life insurance lapse rates by amount of insurance with the Moorhead and Linton tables. The figures are shown in Table 1 of this discussion. (Graduated lapse rates for all ages are not shown in Mr. Brzezinski's paper, but the raw rates were available from the last column at the top of his Table 4.) Moorhead's Table S, which represents average persistency, and Linton's Table A, which represents good persistency, are the ones normally referred to as the standard

tables. The comparisons in Table 1 are not completely valid, since the LIMRA and Moorhead tables use a different method of allocating lapse to policy year. LIMRA defines lapse as failure to pay the first premium for the next year, while Moorhead defines lapse as failure to complete the current policy year. Moorhead therefore has no first-year lapses for annual premium policies, and this explains why his second-year rates are larger in relation to his first-year rates when compared with the other tables. The definition of policy year is very important, since it dictates the formula used for applying the lapse rates in calculations, and it would have been helpful if it had been pointed out in the paper.

Compared with the Linton A table, the LIMRA 1971–72 lapse rates for all ages combined are 67 per cent higher in the first duration, 15 per cent higher in the second duration, and approximately equal thereafter. For reasons noted above, the early duration rates of the LIMRA and Moorhead tables cannot be accurately compared. However, using the lapse rates shown in the tables and ignoring mortality, we can calculate that for LIMRA the lapse rate for the first two years is 0.224 and for Moorhead S, 0.213. Since the LIMRA rate represents twenty-five months of lapse while the Moorhead rate represents twenty-four months of lapse, it appears that the overall level of early lapse rates has not changed much over the last two decades. For the later durations the LIMRA level of lapse is above the Moorhead S until duration 12, when it drops below.

The variation by age in the LIMRA tables is very apparent, and introduction of withdrawal tables varying by issue age into asset share and premium calculations seems to be almost a necessity. The other variations shown in the LIMRA 1971–72 tables, namely, permanent versus term and separation of pension and high early-cash-value business, also seem very useful. Even companies that have developed lapse rate tables based on their own experience may want to modify their tables for these special types of business on the basis of the LIMRA results.

The breaks in lapse rates occurring at attained ages 21 and 65 are also a desirable part of the graduated tables. However, if such tables are to be used at individual ages in asset share and gross premium calculations, discontinuities can result at issue ages where the sharp breaks come into play within the select period. Some type of final smoothing of premiums or dividends might be necessary, which may negate the original accuracy of the lapse rates.

Since the 1971–72 study was the first done by LIMRA, the immediate need for a new expected lapse rate table apparently was an overriding factor in the decision to graduate and publish the results. However, I question Mr. Brzezinski when he states: "Although several years of data

have to be combined to develop mortality tables, the much higher level of lapse rates makes it possible to develop tables with a much smaller volume of exposure." The low level of mortality rates is only one reason for combining several years of data. Another reason is that certain external factors operate over time to vary the mortality rates experienced. Such factors include epidemics and, most recently, a lowering of the speed limits. Other external factors should have an effect on lapse rates from year to year (for example, changes in economic conditions), and these factors can be accounted for properly only in data that combine several years of experience. LIMRA's thirteen-month ordinary lapse survey (which reports lapses in the first policy year only) has shown both upward and downward movements over the past several years. It is to be hoped that, when more data have been collected, LIMRA will publish a set of tables covering several years.

ERNEST J. MOORHEAD:

The author of this valuable contribution to persistency literature begins by referring to the Linton and Moorhead tables, thus encouraging discussion of the differences in approach by the three authors. The most important difference is that Linton and Moorhead offered families of tables, but Brzezinski has given us a single table within each category of business. If LIMRA will publish ratios of actual to expected terminations for aggregations of companies serving different markets, these new tables can also generate such families; however, until this is done, people may tend to treat these new tables as if they give valid industry averages. In fact, this observer has already seen this being done, and has some doubts about it.

It is possible that Mr. Brzezinski regards each of his tables as a reasonable approximation to an industry average. If so, it would be useful to have supporting evidence. Until such is forthcoming, actuaries and others should be wary of taking such an assumption for granted.

How is such evidence to be provided? One hopes that the author will avoid reaching a conclusion by comparing his rates with the figures in LIMRA's own regular lapse study, because the latter cannot be unquestioningly accepted as an industry average, either. It is probably true that a list of the companies that are interested enough to be lapse study contributors includes an abnormal proportion of companies that have been usually successful in controlling terminations. Perhaps the question can be answered by somehow comparing these lapse rates with the rates reported by the Institute of Life Insurance on page 52 of the *Life In-*

surance Fact Book, 1975; presumably the Institute's figures are an unweighted industry cross-section.

It would also be helpful if Mr. Brzezinski would supplement his paper with a table showing the names of the nine contributing companies and the proportion of exposure emanating from each company. It is noted that, in the select section of LIMRA's long-term lapse study, 35 per cent of the exposure by number of policies came from one contributor and 41 per cent of the exposure by amount came from two contributors.

One of the characteristics that differentiate persistency tables is the definition of the policy year to which a termination is assigned. If a policy lapses after premiums have been paid to the end of the nth year, is this a

TABLE 1

VOLUNTARY TERMINATION RATE
(Ordinary Policies in the United States)

	First Two Policy Years	Third and Later Policy Years
1951	9.4%	2.2%
1974	19.5	4.5

lapse at policy year n or at year $n + 1$? The tables published by Moorhead assigned such a lapse to the $(n + 1)$st duration; the author should tell us which definition he has used.

The bulge in termination rates at about age 65 for nonpension policies, shown in Table 1, is of rather special interest. The existence of such a bulge was inquired about in a letter published in *The Actuary* in June, 1973. Answers to that inquiry showed that some companies have experienced such a bulge while others apparently have not. One hypothesis is that the existence of a bulge is a sign that policyholders are receiving better service and attention at retirement time than if the bulge does not occur. It is noted that in these new tables the bulge has a value (the excess of the termination rate at ages 64–65 over the levels five years earlier and later) of about 1.5 per cent of exposed by number of policies and 2 per cent of exposed by amount, which does not suggest that policyholders are being given much encouragement to use accumulated cash values to augment retirement income.

The author's four observations in item 2 on page 269 can, it seems, be summarized by saying that the select period appropriate to the data in this study is considerably longer than fifteen years.

Even though we are the gainers by now having available to us termination rates by quinquennial issue ages, it is still valuable to have the rates for all issue ages combined, which doubtless can be constructed by suitably weighting the values in Table 3 of the paper. It is hoped that Mr. Brzezinski will give us appropriate weighted values in his reply to the discussion.

Our profession will have cause to be grateful if we can continue to welcome papers in the *Transactions* acquainting us with the unfolding results of LIMRA research in persistency. One sad reason why this is needed is that lapse rates apparently have deteriorated seriously during the last quarter-century, as witness the comparison from the *Life Insurance Fact Book* shown in Table 1 of this discussion.

CHARLES F. B. RICHARDSON:

This paper, which gives lapse rate tables, by age and duration, based on actual experience, is long overdue, and Mr. Brzezinski is to be congratulated on a welcome contribution to our knowledge and for his initiative in putting together the data on which it is based.

The reader cannot use the results with confidence unless he has read the LIMRA study, File 720 (1974), on which the tables are based. The following are important questions, and it is hoped that the author may shed light on them in his reply to the discussion.

1. The data are based on the experience of only nine companies (eight for the ultimate portion), and one of these supplied only about 1 per cent of the experience, while one company accounted for no less than 35 per cent of the total experience. That company is a combination operation, and it is known that lapse rates for combination agents differ substantially from those of ordinary agents. In future studies it might be wise to limit the contribution of any one company in any category to some reasonable proportion, say 10 per cent, of the total experience. As more companies join the study, the narrow-base problem eventually will be remedied, but with these data one must ask the following questions:
   a) To what extent is the aggregate experience of these few companies representative of total industry experience—for example, as measured by the LIMRA thirteen-month lapse rate?
   b) What is the range of lapse rates experienced by these companies for the four categories?
   c) What proportion of the total experience for each of the subdivisions, that is, permanent, term, pension, and high-cash-value business, is accounted for by each of the participating companies?
   d) To what extent were term conversions recorded as lapses?

e) What is the mode distribution for each subdivision of the data, and is this representative of the business written by ordinary companies as shown by the LIMRA buyer study? This is important because of the wide variation in lapse rates by mode.

2. The select data for lapse rates on term insurance under ages 15–19 and for pension and high-cash-value business under ages 20–24 are very sparse and not meaningful. They should be omitted for the tables.
3. The ultimate data shown in Table 2 for pension business under age 40 are so scanty that the rates for earlier attained ages cannot be regarded as significant.
4. A comparison of the rates in the ultimate tables with the rates for policy year 15 shows very large differences. For example, ages at issue 35–39 at year 15 show a rate by amount of .0199, and the ultimate rate for age 52 is .0159. On pension business the differences are much greater. Even though the ultimate experience is derived from issues of more than fifteen years ago, the size of these differences is rather surprising.
5. Table 6 shows lapse rates for entry ages 1, 2–4, and 5–9—obviously data errors, since there can hardly have been pension business issued at those ages. Rates under age 14 should be removed from the tables.
6. How were "high early-cash-value policies" defined? This is the first substantial experience that has been made available. I believe that if these products were tested with a realistic interest rate, most of them would show quite substantial losses and asset shares that would never get out of the red. One wonders, also, about the mortality that is likely to be experienced with these high-renewal lapse rates. There is bound to be heavy antiselection.

This is a good example of the valuable research being performed by the LIMRA staff, and we are indebted to the author for this valuable addition to our knowledge about lapse rates.

(AUTHOR'S REVIEW OF DISCUSSION)

JOSEPH R. BRZEZINSKI:

I was very pleased to receive the discussions of my paper from Messrs. Coates, Epstein, Leavitt, McElhaney, Moorhead, and Richardson.

It was not until the discussants reminded me, that I realized that I had omitted the critical definition of the way in which terminations that occur on the anniversary are classified. The LIMRA long-term lapse study, upon which this set of tables is based, utilizes the Linton definition by assigning terminations to the last policy year in which premium was paid or insurance was in force if the policy was paid up. With this definition, we at LIMRA had first-year terminations on the same basis as our thirteenth-month lapse survey and thus had a convenient means of checking individual company results for reasonableness. In many ways, this defini-

tion is also more convenient to actuaries for asset share, model-office, and other actuarial calculations.

Although I can take credit for the development of the expected tables, I must share the credit for the LIMRA study with many LIMRA staff members, a committee of actuaries that did much of the development work on the study (Messrs. Crowe, Bartlett, Spare, and MacIntyre), and the Society's Committee on Ordinary Insurance and Annuities that cooperated in the initial development of the study. The original contributors to the study also deserve considerable credit for their excellent participation.

Mr. Coates's discussion of terminology illustrates some of the difficulties that had to be overcome in designing the lapse study. It was recognized quite early that nonrenewal would distort lapse rates at renewal points. This was especially true of five-year renewable policies. Consequently, it was decided that nonrenewal would be excluded, at least temporarily, until it could be studied as a separate termination rate. In fact, both nonrenewal and conversion to permanent are on LIMRA's schedule for future improvements to the study as soon as they become feasible. "Voluntary termination rate" does come closer to what is actually being measured, but "lapse" is more convenient stylistically and in designing forms.

In the most recently published report on the long-term lapse study, a section was added that directly addressed the issue of variability of overall lapse rates among companies. Future reports will deal with the variation in lapse ratios. LIMRA is continuing to address the variation question in much of the research being conducted with the lapse study data. Although there appears to be little validity in quoting expected rates at the extremely low and high issue ages for pension, term, and high early-cash-value policies, the overriding consideration was the need to have such rates in our computer programs, and some positive value was preferable to a zero value or special programming to handle situations where there is little or no experience.

Since Mr. Epstein's discussion requests additional information similar to that requested by Messrs. Moorhead and Richardson, I will respond to all three discussions in some detail later on. Mr. Leavitt's presentation of lapse rates experienced by New York savings bank life insurance does indeed permit a more precise comparison of rates than has previously been possible. The differences are both striking and expected. I would prefer to characterize them as reflecting the different persistency of business that is bought rather than sold. Many insurance companies claim experi-

ence similar to that reported by Mr. Leavitt on their "walk-in" purchases of life insurance.

LIMRA publications long have recognized the differences in persistency by mode of premium payment, as have numerous other sources. The reason that frequency was not considered as a factor in the first LIMRA long-term lapse study was that most contributors were utilizing mortality files to develop their experience, and mode was not available. In 1976 the study is expanding considerably both in scope of investigation and in number of participating companies, and mode will be studied.

Mr. McElhaney has provided several useful comparisons between the LIMRA expected tables and the Linton and Moorhead tables. However, his conclusion about there being little change in lapse rates is not necessarily valid. To quote Mr. Moorhead about his tables, "No pretense whatever is made that these are standard tables that fit any single known experience, and certainly no inference that they represent industry averages or yardsticks of any kind is justified." By the same token, the LIMRA study cannot be considered representative of the industry in 1971–72. I will cover this subject in greater detail in my review of the discussions of Messrs. Epstein, Moorhead, and Richardson.

The variation in age that Mr. McElhaney discusses has been mentioned in various studies of persistency published by LIMRA or in the *Transactions*. The pooling of companies and the use of a format similar to the Society's mortality studies, however, has made it possible to develop a finer resolution of the differences by age than was previously possible.

During the next several years, the LIMRA long-term lapse study should be able to accumulate considerably more data and information about characteristics of buyers and the insurance being purchased to develop much better expected tables. It is quite possible that several years of data may have to be combined to develop such tables.

Messrs. Epstein, Moorhead, and Richardson expressed an interest in the companies upon which the new tables are based. Table 1 of this review indicates the companies that participated in the first year of the LIMRA study and their relative proportions to the total exposure. The experience does include the experience of one very large company, but, except for three smaller companies, the companies contributing to the study are similar in size. All except one company are participating. The sample contains both branch office and general agency companies. The reader should keep in mind that these are companies that were both willing and able to contribute to the long-term lapse study. As a result, no attempt was made to ensure that the sampling would be representa-

tive of the industry during the study period or that the sampling would contain enough diversity to generalize about the experience of specific types of companies or of aggregations of companies serving different markets.

Both Mr. Moorhead and Mr. Richardson expressed an interest in the extent to which the aggregate experience is representative of the total industry. Mr. Moorhead has discussed very ably the difficulty in providing such evidence. At the current time there are several sources of "in-

TABLE 1

DISTRIBUTION OF EXPOSURE

COMPANY	SELECT		ULTIMATE	
	Number	Amount	Number	Amount
Connecticut Mutual Life	10.7%	12.2%	9.6%	13.6%
Continental American Life	.....	1.3	.....	1.2
John Hancock Mutual Life	34.8	21.8	35.7	18.7
Lincoln National Life	4.5	5.6	.....	.....
Massachusetts Mutual Life	11.8	19.3	6.7	12.3
Mutual of New York	13.7	13.0	19.1	18.0
New England Life	12.3	13.9	7.0	12.9
Penn Mutual	8.6	8.3	16.0	15.7
Provident Mutual Life	3.6	4.6	5.9	7.6

dustry" data on lapsation other than the long-term lapse study, the most commonly known of which are the Institute of Life Insurance rates, to which Mr. Moorhead alluded, and the LIMRA thirteen-month lapse survey. Unfortunately, neither of these well-known sources shows rates that are fully comparable to the rates in the 1971–72 expected tables. The ILI rates are ratios of terminations to mean in-force separately for policies in force less than two years and policies in force two years or more. The numerator and denominator in each case are made up of different blocks of business. The LIMRA rate is a thirteen-month rate that is developed as a weighted average of monthly rates (the numerator is a sum of twelve months' lapses, and the denominator is the sum of twelve months' average twelve-month exposure). As a result of the method of calculation, the ILI rate is susceptible to some distortion due to the rate of growth in new business, and to a negligible extent the LIMRA rate has the same problem (the error for the LIMRA rate is probably around 0.25 per cent on a lapse rate of 17.5 per cent for a growth of 10 per cent per year).

Table 2 of this review illustrates the history of these various lapse rates over the last half-century. For the period 1951–61, both the ILI and the LIMRA rates were on a two-year basis, during which time there was a fairly consistent difference between the two rates. About 5 points of the difference might be attributed to the difference in the methods of calculation. Much of the remaining difference can be ascribed to the fact that

TABLE 2

COMPARISON OF VARIOUS LAPSE RATES

Year	LIMRA 24-Month Rate	Year	LIMRA 24-Month Rate	ILI 2-Year Rate	LIMRA 13-Month Rate
1925	20.0%	1950	16.3%	.....	.....
1926	20.2	1951	15.9	9.4%	.....
1927	20.9	1952	15.4	9.7	.....
1928	19.2	1953	17.1	9.9	.....
1929	19.5	1954	18.2	11.7	.....
1930	22.9	1955	17.8	11.4	.....
1931	23.8	1956	17.9	11.5	.....
1932	28.1	1957	19.0	13.0	.....
1933	28.0	1958	21.0	14.5	.....
1934	26.0	1959	19.8	13.5	.....
1935	24.0	1960	20.9	14.5	.....
1936	20.0	1961	21.7	15.6	17.6%
1937	19.0	1962	Discontinued	15.3	17.9
1938	21.0	1963	.....	15.7	17.6
1939	18.0	1964	.....	15.6	16.4
1940	18.0	1965	.....	15.4	16.5
1941	17.0	1966	.....	16.2	16.7
1942	16.0	1967	.....	16.5	16.8
1943	13.0	1968	.....	18.0	17.0
1944	12.0	1969	.....	18.3	17.4
1945	11.0	1970	.....	19.3	18.9
1946	13.5	1971	.....	19.0	18.3
1947	16.7	1972	.....	19.3	17.2
1948	15.4	1973	.....	18.8	16.7
1949	16.2	1974	.....	19.5	16.8

one rate measures policies lapsing and the other measures amount of insurance. LIMRA staff members feel that the thirteen-month rate probably understates the actual total industry rate, since the LIMRA sample of companies underrepresents the smaller insurance companies.

The 1971–72 expected tables end up with an aggregate expected rate that is higher than the LIMRA ordinary rate but lower than the ordinary rate that includes the ordinary business of combination agents. Accordingly, the new expected tables probably represent an average persistency that is slightly better than that for all ordinary business.

This discussion leads to a review of the purpose for which the new expected tables were constructed. The paper states the purpose as "to replace the use of Linton and Moorhead lapse tables in the future analysis of lapse trends in the intercompany experience of the LIMRA long-term lapse study." Thus I view the tables much in the way Mr. Coates has indicated—as "valuable reference points for future studies . . . in considering their own experience." The tables have been constructed so that they could partial out effects of distribution by age, duration, and type of policy within various summary tables that will be used in future reports. With the new expansions of the lapse study, newer tables eventually will be possible, so that we will have a research tool that will help us differentiate between changes in lapse rates and changes in distribution of sales and in-force that might give rise to changes in persistency. The tables also give us a valuable tool to help us evaluate the relative association of other factors and characteristics of companies or agents or business sold with the persistency of that business. For individual companies the new tables can be most helpful in the development of individualized lapse tables and in the development of persistency rating charts, where the tables can make it possible to develop valid "raters" with smaller samples than would otherwise be necessary. Used for these purposes, the new tables are extremely valuable even if they do not represent a fully valid industry average.

The problems with the narrow base in the 1971–72 expected lapse tables should always be kept in mind in interpreting the results of these tables. Among the companies contributing to the LIMRA study the best record of participation occurred in the experience on separation between term and permanent insurance. Fewer companies participated in the experience under pension and high early-cash-value insurance. We at LIMRA have kept a close watch on the ratio of actual to expected experience in subsequent studies as an additional check on the validity of the lapse patterns developed in the new tables. For the most part, we find that for the companies that formed the original base the tables continue to be fairly good, with some fluctuation about the expected values. The newer companies in the study appear to have patterns similar to those developed in the expected tables, with some variation in level of rates. Actuaries often utilize a transformation of the form $aq + b$ in adapting standard tables to fit their own company experience. With minor modification, the same sort of transformation would probably work with the new tables. That is, a technique similar to that utilized in developing the new tables would probably work very well, especially if a "dummy variable multiple regression" were to be used to adapt rates differently for dura-

tions 1, 2, 3–5, 6–10, and 11–15. This same technique would make it possible to fit the transformation to recognize peculiarities in a company's experience that would be associated with practices in determining the incidence and level of nonforfeiture values or with persistency bonuses that cause differences in lapse experience.

As Mr. Richardson has stated, the narrow-base problem will be remedied eventually when more companies join the study. More companies will create other problems, however, since the broader base will be even less homogeneous than with the current narrow base. We at LIMRA are now experimenting with a number of methods to handle these problems. In essence, the problem is to make the study meaningful and useful to

TABLE 3

AGGREGATE EXPECTED LAPSE RATE BY DURATION

Policy Year	Number	Amount	Policy Year	Number	Amount
1	.2024	.1632	9	.0310	.0316
2	.0930	.0822	10	.0290	.0293
3	.0643	.0624	11	.0275	.0276
4	.0544	.0547	12	.0270	.0265
5	.0514	.0489	13	.0258	.0257
6	.0434	.0404	14	.0240	.0242
7	.0393	.0373	15	.0235	.0227
8	.0344	.0340			

all companies in the study. As smaller companies join in the study, continuance of tabular forms that have all the age and duration detail in the current study will not provide meaningful data to the contributor. We intend to continue our practice of returning tabulations of a contributor's experience to the contributor and are developing an abbreviated tabular form that will combine current age groupings into broader age groupings that will have greater statistical significance to the contributor. In combining company results for intercompany tabulations for contributors and for reports, we are experimenting with methods of scaling down the experience of the largest companies so that the intercompany results will represent more nearly an average of company results, giving each company equal weight.

Table 3 of this review contains the rates for all issue ages combined that Mr. Moorhead requested. In my paper, I did not show expected lapse rates for all durations combined, since I wished to emphasize the fact that the expected lapse rates on such a basis would be a function of the distribution of business by type and age. For any of the tables show-

ing the composite tests by duration, the aggregate expected lapse rate can be obtained by dividing the expected lapses by the exposure.

After reading Mr. Moorhead's comparison of lapse rates in 1951 with those in 1974, I began a little extra research into the differences. Looking at the historical rates table and breaking the period from 1951 to 1974 into 1951–61 and 1961–74, we can compare the results of LIMRA's two surveys with the results of the ILI. From 1951 to 1961 the LIMRA twenty-four-month survey showed a 36 per cent increase (from 15.9 to 21.7) in twenty-four-month lapsation, while the ILI data show a 66 per cent increase (from 9.4 to 15.6) in lapsation. From 1961 to 1974 the ILI data show an additional increase of 25 per cent or an increase of 107 per cent from 1951 to 1974. The LIMRA thirteen-month survey showed a decrease in lapsation from 1961 to 1974 of 5 per cent. Combining the two LIMRA survey results under the assumption that changes in thirteen-month rates parallel changes in twenty-four-month rates would indicate that lapsation rose by about 30 per cent from 1951 to 1974. If we assume that the data developed by both LIMRA and the ILI are valid, then the difference might be ascribed to the relative changes in the bases of the two studies. That is, relative to the LIMRA study company participation, the participation in the ILI study may have expanded by including more companies with poorer persistency and smaller policies, or, possibly, some companies with better persistency may have dropped out. The difference could also be explained partially by the differing ways in which the two studies respond to growth in new sales. Growth rates in new business have not varied too much over the last two decades, being in the 8–10 per cent range for volume and 2.5–3.5 per cent for number of policies.

Looking at the 1951 and 1974 figures from another point of view, is there any reason to believe that lapse rates have gone up simply because of distributional changes? The period from 1951 to 1974 has seen a number of changes in the distribution of business by age, by sex, by type of insurance, and by mode of premium payment. Often we feel that today's market is made up of a "younger populace" than in the early 1950's. Surprisingly enough, the average age of buyer in 1973 was nearly two years greater than the average age of buyer in 1949 (27.91 versus 25.95). This peculiar result follows from a shift from the juvenile market to the young adult market as a percentage of sales and from a larger proportion of insureds at higher ages of issue. This is an interesting result, but preliminary calculations indicate that the shift has negligible effect on the level of expected lapsation.

There has also been a shift in the distribution of buyers by sex since 1949. A comparison of 1949 and 1973 indicates the following:

	1949	1973
Male	65.2%	66.0%
Female	14.3	21.9
Juvenile	20.5	12.1

Although much has been said about the differences in persistency associated with the sex of the insured, the shift in this distribution is unlikely to affect expected lapse rates to any significant degree.

The shift in distribution of sales by mode of premium payment has shifted dramatically over the last quarter-century. The accompanying tabulation indicates the shifts that have taken place. I have included

	1949	1960	1973
Annual	40%	26%	26%
Semiannual	14	10	8
Quarterly	30	22	15
Monthly	11	23	20
Monthly bank	.....	13	25
Salary savings	5	6	6

the 1960 figures, since data do exist at LIMRA by which comparisons of persistency can be made. Follow-up research was done on both the 1949 buyer sample and the 1960 buyer sample that LIMRA had collected. In 1962 it was noted that, "while the persistency for each mode is almost identical in the two periods [under study], the overall two-year persistency has dropped from 74% to 72%." This study dealt primarily with the sales of ordinary agents to male adults; the modal distribution shown in the column for 1960 is for sales of ordinary agents to male adults, while the other distributions are for all sales. The modal changes can be assumed to have had a significant impact upon the levels of expected lapse rates.

The shifting of the distribution of sales between permanent and term and, within permanent, the substantial increase of family plan insurance have also been dramatic over the last quarter-century. In the report mentioned above, it was noted that "a substantial increase in pure family plan policies . . . which have a relatively low persistency . . . appears to

be another major contributor to the failure of 1960 policies to show improved persistency."

Although I do not have sufficient time to develop fully the details of the changes in persistency from 1949 to 1974 as indicated by various LIMRA surveys, studies, and reports in this review of the discussion, I have asked the staff at LIMRA to initiate such a study for presentation to the industry either in a LIMRA publication or in a paper to be submitted to one of the Society's publications. A little more research does appear to be called for.

Mr. Epstein has also asked for several technical details about the data and the construction that have not been covered in the paper or in the preceding discussion. Various steps were taken to assure the "purity" of the data. I have already mentioned that comparisons were made with the LIMRA thirteen-month lapse rates on a company-by-company basis. The processing of the data sent to LIMRA was subjected to a variety of edit and control total checks at all stages. As part of the processing, LIMRA does calculate expected values and produces a complete set of tabulations, a copy of which is sent to the contributor for final review. The LIMRA staff also reviews each company's contribution and the unfolding results throughout the entire process. For companies that have been in the study for more than one year, we compare the results for each year to see whether there is any inconsistency among years. For the first study, in many areas we really did not know what to expect. It has been quite a learning process (we are currently processing results of the third study), and I like to think that the knowledge gained has improved the study. In several ways the development of the new tables and the statistical tests made on the results also have helped to confirm the "purity" of the data in our minds.

Several methods of graduation were attempted, in addition to the Whittaker-Henderson type B method finally used. Preliminary tests were initiated with graphs of raw results. We considered briefly graduation by mathematical formula but decided against it because the data had various peculiarities that we wished to retain. We also considered the use of spline functions; preliminary tests indicated that spline functions would probably work very well. Actually, the Whittaker-Henderson process can be thought of as a special case of a discrete spline. We did have a convenient Whittaker-Henderson type B program available to us through our time-sharing service, so it was a natural to use. Our time-sharing service also had a Bayesian graduation program available, but we decided against its use primarily because of our unfamiliarity with the

process and our uncertainty concerning the appropriate a priori assumptions, and because of our familiarity with the Whittaker-Henderson method.

The semi-Bayesian method for pension and high early-cash-value data involved supplementing the actual data with "expected data" in cells where the experience was very sparse. Where the data were very sparse, various groupings of cells were made to develop new cells in which the data would be more or less homogeneous and statistically significant. These data were then graduated to form a smooth progression of values by duration. As I understand Bayesian statistics, an a posteriori set of averages for a binomial process equals $(a + b)/(c + d)$, where a and c can be taken as actual lapses and exposure and b and d represent expected lapses and exposure based upon previous experience. In the process actually used, b was set equal to 5 and d was determined from knowing b and the appropriate lapse rate from the previous graduation. The b's and d's so developed were added to the corresponding a's and c's by age group and duration. I think that this process is similar to processes that have been used in developing experience credibility with group insurance.

I have described some of the tests made with the tables in a talk given at the Actuarial Research Conference in Providence last summer. Readers can refer to the proceedings of the conference or write to me to obtain copies of the talk. Some of the computer problems that were encountered in developing the new tables were discussed in the same talk. Analysis of errors was required, and, as a result, data used in developing the tables and checking the results had to be presorted to minimize computational errors.

I congratulate Mr. Epstein on his excellent bibliography of papers covering lapsation of life insurance that have appeared in actuarial publications. Lapsation is a topic of research that is catalogued in File 720 of LIMRA's publications. Readers should refer to this file if they seek additional information. The two published reports on the results of the long-term lapse study should have all the information necessary at least to begin to answer Mr. Epstein's three questions on factors affecting persistency.

In conclusion, LIMRA and I will retain interest in lapse and persistency work through the expansions of the lapse study already initiated and, over the longer term, through investigations into conversion and renewal of term insurance, investigations into rates of premium payment and the incidence of lapsation within the policy year, and similar studies of the persistency experience of annuity and accident and health business. At

the same time, I hope to be able to increase productivity and to turn some of our attention to studies of agent and agency retention and productivity and to studies that develop tables of expected marketing costs under various conditions. I hope that members of the Society will persist in their support of these endeavors as they have in the development and continuing operation of the LIMRA long-term lapse study.