II. CANADIAN ASSURED LIVES TABLES, 1958–64

THE Committee on Mortality of the Canadian Institute of Actuaries has constructed new mortality tables for males and females separately based on the experience under Canadian Standard Ordinary issues. The main reason for the preparation of new mortality tables was to have available up-to-date sex-distinct mortality tables as a basis for comparison in connection with the mortality studies being conducted annually by the Institute. In graduating the tables, closeness of fit to the basic data has, therefore, been a prime consideration, and the graduation was designed to reflect closely actual experience for the period of the study with no built-in mortality margins. Graduated select and ultimate rates of mortality were constructed for male lives and graduated ultimate rates only for female lives. These rates of mortality are shown in Table 1.

The basic data were obtained from twenty-five companies, representing about 84 per cent by amount of the life insurance in force in Canada. The names of the companies which contributed data are shown in Table 2. The material includes the experience of both medically examined and nonmedical issues. The period covered is that between the 1958 and 1964 policy anniversaries, during which the mortality on Canadian Standard Ordinary issues has been reasonably level.

The data were contributed by the individual companies on an age at issue and policy year duration basis for the first five policy year durations and on an attained age basis for subsequent policy year durations. This form has been retained in the graduated rates of mortality.

Data used in the study were recorded on nearest age basis. The male data were adequate for the construction of select and ultimate tables, but the female data were inadequate for the preparation of select rates. For males the deaths in the study totaled 63,345 by policies and about $229 million by amounts. For the female experience the deaths totaled 5,632 by policies and about $8.8 million by amounts. The total exposed to risk for male lives exceeded 13 million by policies and $65 billion by amounts; the corresponding figures for females exceeded 3.7 million by policies and were about $6.5 billion by amounts.

Graduation of the Ultimate Rates of Mortality

For the main range of ages of the ultimate male data (policy year durations 6 and subsequent), a Whittaker-Henderson B formula was used to

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TABLE 1

CANADIAN ASSURED MALE LIVES TABLE, 1958–64
GRADUATED RATES OF MORTALITY PER 1,000

Issue Age $[x]$	$q_{[x]}$	$q_{[x]+1}$	$q_{[x]+2}$	$q_{[x]+3}$	$q_{[x]+4}$	q_{x+5}	Attained Age $x+5$
0	3.365	0.910	0.752	0.639	0.561	0.507	5
1	0.910	0.752	0.639	0.561	0.507	0.467	6
2	0.752	0.639	0.561	0.507	0.467	0.426	7
3	0.639	0.561	0.507	0.467	0.426	0.380	8
4	0.561	0.507	0.467	0.426	0.380	0.338	9
5	0.507	0.467	0.426	0.380	0.338	0.323	10
6	0.467	0.426	0.380	0.338	0.323	0.320	11
7	0.426	0.380	0.338	0.323	0.320	0.340	12
8	0.380	0.338	0.323	0.320	0.340	0.388	13
9	0.338	0.323	0.320	0.340	0.388	0.468	14
10	0.323	0.320	0.340	0.388	0.468	0.584	15
11	0.320	0.340	0.388	0.468	0.584	0.715	16
12	0.340	0.388	0.468	0.584	0.715	0.855	17
13	0.388	0.468	0.584	0.715	0.855	0.972	18
14	0.468	0.584	0.715	0.855	0.972	1.052	19
15	0.584	0.715	0.855	0.972	1.052	1.097	20
16	0.715	0.855	0.972	1.052	1.097	1.127	21
17	0.855	0.972	1.052	1.097	1.127	1.129	22
18	0.972	1.052	1.097	1.127	1.129	1.105	23
19	1.052	1.097	1.127	1.129	1.105	1.063	24
20	1.060	1.101	1.117	1.105	1.063	1.012	25
21	1.051	1.077	1.081	1.063	1.012	0.960	26
22	1.015	1.029	1.029	1.012	0.960	0.917	27
23	0.957	0.965	0.969	0.960	0.917	0.889	28
24	0.885	0.895	0.908	0.917	0.889	0.880	29
25	0.807	0.826	0.857	0.889	0.880	0.891	30
26	0.753	0.776	0.817	0.874	0.891	0.922	31
27	0.708	0.740	0.795	0.870	0.922	0.973	32
28	0.675	0.721	0.792	0.885	0.973	1.042	33
29	0.657	0.718	0.806	0.919	1.042	1.128	34
30	0.654	0.731	0.837	0.968	1.122	1.229	35
31	0.666	0.758	0.881	1.031	1.203	1.339	36
32	0.691	0.799	0.938	1.105	1.289	1.458	37
33	0.728	0.850	1.006	1.184	1.380	1.588	38
34	0.775	0.911	1.078	1.267	1.479	1.736	39
35	0.831	0.976	1.154	1.358	1.590	1.913	40
36	0.890	1.046	1.236	1.460	1.723	2.122	41
37	0.953	1.120	1.329	1.582	1.880	2.370	42
38	1.021	1.204	1.441	1.726	2.065	2.662	43
39	1.098	1.305	1.572	1.896	2.281	3.002	44
40	1.190	1.424	1.726	2.095	2.530	3.393	45
41	1.298	1.564	1.907	2.324	2.813	3.832	46
42	1.426	1.728	2.116	2.583	3.125	4.312	47
43	1.576	1.917	2.352	2.870	3.459	4.820	48
44	1.748	2.132	2.614	3.177	3.803	5.349	49
45	1.944	2.369	2.893	3.494	4.152	5.895	50
46	2.160	2.622	3.182	3.815	4.502	6.465	51
47	2.392	2.884	3.475	4.136	4.859	7.077	52
48	2.631	3.150	3.768	4.464	5.233	7.751	53
49	2.873	3.416	4.067	4.809	5.641	8.503	54

TABLE 1—*Continued*

Issue Age $[x]$	$q_{[x]}$	$q_{[x]+1}$	$q_{[x]+2}$	$q_{[x]+3}$	$q_{[x]+4}$	q_{x+5}	Attained Age $x+5$
50...	3.116	3.687	4.382	5.184	6.090	9.350	55
51...	3.364	3.973	4.724	5.597	6.592	10.316	56
52...	3.625	4.284	5.101	6.059	7.160	11.428	57
53...	3.909	4.627	5.523	6.582	7.809	12.715	58
54...	4.223	5.010	6.000	7.180	8.556	14.198	59
55...	4.573	5.443	6.546	7.867	9.409	15.884	60
56...	4.970	5.940	7.174	8.653	10.368	17.765	61
57...	5.424	6.510	7.892	9.537	11.424	19.822	62
58...	5.946	7.163	8.699	10.510	12.559	22.027	63
59...	6.543	7.898	9.589	11.557	13.755	24.359	64
60...	7.216	8.707	10.546	12.659	14.994	26.812	65
61...	7.957	9.579	11.554	13.803	16.271	29.398	66
62...	8.755	10.497	12.601	14.982	17.594	32.141	67
63...	9.597	11.450	13.681	16.204	18.974	35.068	68
64...	10.471	12.435	14.800	17.479	20.425	38.197	69
65...	11.375	13.456	15.970	18.821	21.956	41.544	70
66...	12.312	14.523	17.201	20.238	23.575	45.123	71
67...	13.292	15.647	18.501	21.735	25.285	48.959	72
68...	14.326	16.835	19.876	23.319	27.098	53.081	73
69...	15.418	18.092	21.331	25.000	29.030	57.532	74
70...	16.575	19.422	22.876	26.791	31.099	62.370	75
						67.655	76
						73.428	77
						79.705	78
						86.475	79
						94.120	80
						102.815	81
						112.528	82
						123.019	83
						133.843	84
						145.116	85
						156.763	86
						168.733	87
						180.999	88
						193.546	89
						206.364	90
						219.444	91
						232.780	92
						246.368	93
						261.776	94
						280.574	95
						304.329	96
						334.609	97
						372.984	98
						421.022	99
						480.291	100
						552.359	101
						638.796	102
						741.169	103
						861.048	104
						1,000.000	105

TABLE 1—*Continued*

CANADIAN ASSURED FEMALE LIVES, 1958–64
GRADUATED ULTIMATE RATES OF MORTALITY PER 1,000

Age x	q_x	Age x	q_x	Age x	q_x
0	2.610	35	0.945	70	21.702
1	0.774	36	1.012	71	24.382
2	0.612	37	1.083	72	27.472
3	0.499	38	1.158	73	31.015
4	0.423	39	1.239	74	35.047
5	0.373	40	1.329	75	39.590
6	0.338	41	1.432	76	44.658
7	0.307	42	1.554	77	50.261
8	0.280	43	1.703	78	56.404
9	0.259	44	1.885	79	63.095
10	0.246	45	2.104	80	70.337
11	0.241	46	2.355	81	78.134
12	0.246	47	2.632	82	86.486
13	0.258	48	2.926	83	95.395
14	0.276	49	3.226	84	104.872
15	0.298	50	3.527	85	114.935
16	0.321	51	3.830	86	125.612
17	0.345	52	4.138	87	136.941
18	0.366	53	4.460	88	148.964
19	0.381	54	4.804	89	161.736
20	0.390	55	5.184	90	175.319
21	0.392	56	5.610	91	189.783
22	0.387	57	6.089	92	205.207
23	0.380	58	6.626	93	221.679
24	0.373	59	7.223	94	239.295
25	0.374	60	7.886	95	258.159
26	0.386	61	8.624	96	279.022
27	0.412	62	9.454	97	303.280
28	0.453	63	10.394	98	332.972
29	0.509	64	11.461	99	370.785
30	0.577	65	12.670	100	420.049
31	0.652	66	14.039	101	484.742
32	0.729	67	15.591	102	569.486
33	0.805	68	17.357	103	679.547
34	0.877	69	19.378	104	820.838
				105	1,000.000

graduate the rates of mortality based on the experience by amounts. For the main range of ages of the ultimate female data (durations 6 and subsequent), a Whittaker-Henderson B formula was also used to graduate rates of mortality based on the experience by number of policies. Because there were fewer data on female lives, it was found that a graduation by policies produced a table which more adequately expressed the mortality of female lives.

TABLE 2

COMPANIES CONTRIBUTING DATA TO THE CANADIAN MORTALITY INVESTIGATION

Canada Life Assurance Company
Confederation Life Association
Crown Life Insurance Company
Dominion Life Assurance Company
Empire Life Insurance Company
Equitable Life Insurance Company of Canada
Excelsior Life Insurance Company
Great-West Life Insurance Company
Imperial Life Assurance Company of Canada
Industrial Life Insurance Company
London Life Insurance Company
Manufacturers Life Insurance Company
Metropolitan Life Insurance Company
Monarch Life Assurance Company
Mutual Life Assurance Company of Canada
National Life Assurance Company of Canada
New York Life Insurance Company
North American Life Assurance Company
Northern Life Assurance Company of Canada
Occidental Life Insurance Company of California
Prudential Assurance Company Limited (of England)
Prudential Insurance Company of America
Sun Life Assurance Company of Canada
T. Eaton Life Assurance Company
Travelers Insurance Company

Graduation of Select Rates of Mortality

In graduating the select rates of mortality for male lives, it was found that selection at the older ages extended beyond the fifth policy year. It was felt, however, that reasonably close adherence to the actual experience was desirable even though this produced a sharp discontinuity between the graduated mortality rates at the older ages for the fifth policy year duration and the ultimate section. For the main range of ages 20–69 in the select section, the degree of selection appeared to increase with age and King's method of constructing select rates was used, as described in Volume LIII of *J.I.A.*

Comparison with Other Tables

A comparison of the rates of mortality of the Canadian Assured Male Lives Ultimate Table, 1958–64 (C.A. 58–64 Males Ultimate), and the Canadian Assured Female Lives Ultimate Table, 1958–64 (C.A. 58–64 Females Ultimate), with those of other recent mortality tables is shown in the accompanying tabulation.

The C.A. 52–56 Ultimate Table was based on the experience after the exclusion of the first five policy years under Canadian Standard Ordinary

COMPARISON OF ULTIMATE RATES OF MORTALITY ($q_x \times 1{,}000$)

Age	C.A. 58–64, Males	C.A. 52–56, Male and Female Combined	1955–60 Basic Table, Males	Table X18, Male and Female Combined	C.A. 58–64, Females	1955–60 Basic Table, Females
15	0.58	0.59	0.73	0.55	0.30	0.36
25	1.01	1.06	1.25	0.93	0.37	0.66
35	1.23	1.35	1.40	1.41	0.94	1.21
45	3.39	3.51	3.96	4.02	2.10	2.32
55	9.35	10.32	11.00	10.91	5.18	5.67
65	26.81	26.56	27.99	27.61	12.67	13.07
75	62.37	64.63	63.36	63.80	39.59	43.59

issues. The 1955–60 Basic Tables for males and females cover ultimate experience after the exclusion of the first fifteen policy years. Table X18 excludes a five-year select period and is based on experience for the period 1950–54. In comparing the new tables with existing tables, the differences with regard to sex, periods of observation, and select period excluded should be taken into consideration.

More detailed data, including a description of the graduation process and additional comparisons with other mortality data, are included in the Canadian Institute of Actuaries Mortality Committee Report, dated February, 1967.