SINGAPORE ACTUARIAL SOCIETY

MORTALITY INVESTIGATION 1997 – 2002

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The Workgroup has carried out significant checking of the raw data supplied by contributors for invalid or inconsistent data and to provide a useful interpretation of these results. Nevertheless, the Workgroup cannot accept any responsibility for errors or other consequences arising from the use of the information contained in this report. Actuaries and others using this report should exercise professional care and judgement in ensuring that they are suitable for the intended purpose. Readers are also reminded that past experience is not always a good guide for the future.

ACKNOWLEDGEMENTS

Special thanks should also be given to Professor Beda Chan[1] of the University of Hong Kong for providing advice on and reviewing the graduation.

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1   EXECUTIVE SUMMARY

It is well known that the insured lives generally exhibit mortality experience which is better than that of the general population due to the selection effect of underwriting by the insurers. Insurers use information about the mortality experience of insured lives in their pricing of insurance products and in their estimation of the reserves that they need to set up to meet future obligations arising from the policies they sold. As most insurers do not have sufficient data themselves to derive a set of graduated mortality rates for insured lives, an industry study of insured lives mortality experience, combined with a graduated mortality table derived from the industry experience forms a useful alternative.

The previous investigation of the insured lives experience for the life insurance industry in Singapore was conducted for the period 1990 to 1995. However, the investigation for that period only provided a comparison of experience against existing graduated mortality tables and did not provide a new set of graduated mortality rates. The previous sets of graduated rates available for the Singapore insured lives were based on experience for the period 1988 to 1993 (S8893), and 1983 to 1988 (S8388). Clearly, there has been a gap in the availability of information pertaining to mortality experience of insured lives in Singapore after 1995.

The Singapore Actuarial Society (SAS) has recognized this gap and has formed a Mortality Study Workgroup to investigate the mortality experience of insured lives in Singapore from 1997 to 2002. As the data from individual companies are confidential and are only available to the Monetary Authority of Singapore (MAS), the Workgroup worked closely with the MAS on the compilation and processing of data to derive the necessary statistics for the mortality investigation and graduation.

The Workgroup derived a set of graduated mortality rates (S9702) for insured lives with the following characteristics:

- aged between 15 and 99 nearest birthday during the period of investigation;

- insured under whole life and endowment policies;

- accepted at standard rates, comprising both medically underwritten and non-medically underwritten lives;

- policy curtate duration of 2 years or more;

- without 100% critical illness acceleration coverage;

- differentiated between males and females;

- the investigation is based on number of policies, not on number of lives, nor on size of sums assured.

Unlike the previous mortality investigations, the Workgroup decided to exclude from the analysis life insurance policies that offer a 100% acceleration of the death benefit upon the diagnosis of critical illness, as these policies are likely to result in an understatement of the mortality rates.

Various methods were used in the graduation of the mortality rates which are described in further detail in the main body of the report. The graduated rates demonstrated an overall goodness of fit to the crude rates and passed the test for smoothness.

Some observations from the S9702 graduated rates table are as follows:

- The male S9702 rates exhibit the usual hump at age 21 reflecting the higher incidence of accident around that age. Although the Workgroup noticed another hump in the raw data in the late 20's, the Workgroup felt that further investigation would be required to identify the reasons for the hump as this is not a common feature in mortality curves.

- The mortality rates from S9702 are generally lower than the previous two tables. The improvement in assured lives mortality rate over the 14 years from the midpoint of the 1983-1988 experience to the 1997-2002 experience averaged around 3.5% for males and 2.4% for females. This is in line with the

Singapore population, although this level of mortality improvement would be considered high compared to most developed countries.

- The Workgroup noted that while the ratios of male insured lives mortality rates to population mortality rates remained relatively stable over the three graduated tables (S8388, S8893 and S9702), the corresponding ratios for female lives increased from the S8388 table to the S9702 table. This could be related to the change in the mix of female lives in the insured population over time but the Workgroup was not able to draw any firm conclusions based on this study.

Although S9702 provides insurers with the latest mortality experience of the insured lives in Singapore, the Workgroup feels that further investigations would be useful, including a breakdown by smoking status. SAS is well aware of the usefulness of such further investigations and looks forward to future collaborations with the MAS and the industry to initiate these and other experience investigations.

2   INTRODUCTION

The Singapore Actuarial Society (SAS) formed a Mortality Study Workgroup in September 2001 to investigate the mortality experience of the insured lives in Singapore over the period 1997 to 2002 and to establish mortality tables reflecting the actual experience over this period. This report outlines the work that had been carried out and provides a set of mortality tables (S9702) produced from the study.

The previous investigation of the insured lives experience in Singapore was conducted in 1996 for the period 1990 to 1995. This investigation provided an update on the mortality experience but did not include a graduation of the experience. The latest graduated mortality tables for Singapore were based on experience of insured lives, under Whole Life and Endowment Insurances, for the period 1988 to 1993.

It is worth highlighting that in this investigation, unlike the previous ones, we made explicit adjustments to the insured lives data by removing from the analysis life insurance policies that offer a 100% acceleration of the death benefit upon the diagnosis of critical illness. As these policies would terminate upon the payment of the critical illness benefit, any deaths subsequent to diagnosis of a critical illness would not be recorded in the mortality investigation data. Given the increasing prevalence of policies with critical illness cover in Singapore since early 1990s, we considered it important to exclude these policies so as not to understate the mortality experience caused by the exclusion of deaths subsequent to diagnosis of a critical illness. Due to the lack of adequate information on policies with critical illness prior to 1997, we confined our investigation to the period 1997 to 2002.

Section 3 of this report sets out the basic data used in the analysis, the data adjustment, selection and verification processes. Methods of graduation adopted for various age ranges of the male and female mortality tables are described in Section 4. Sections 5, 6, and 7 present the results in depth and compare the proposed graduated tables with other mortality information. Section 8 sets out the considerations for future research.

3 THE DATA

3.1 The Workgroup worked with three sets of data for the investigation period from 1997 to 2002. Each set of data shares the following characteristics:

- Based on whole life and endowment policies;
- Based on policies issued at standard rates;
- Split between males and females;
- Split by individual ages, from age 0 to 99;
- Split by curtate duration into 0, 1, 2, 3, 4 and 5+
- Split between medically underwritten and non-medically underwritten (except for Set 3 data, where there is no breakdown for medical and non-medical lives);
- Based on number of policies, not on number of lives, nor on size of sums assured.

The three sets of data were:

Set 1: Combined information from all life insurers

Set 2: Combined information from the top four life insurers by business volume

Set 3: Combined information on policies with 100% acceleration critical illness benefits from the top four life insurers by business volume

The raw data are given in Appendix G.

3.2 The first two sets of data were compiled directly from direct life insurers annual submissions to MAS in accordance with the requirements under MAS Notice 303, and the third set of data was compiled from additional data request conducted by MAS from the top four insurers, AIA, Great Eastern Life, NTUC Income and Prudential. The detailed formats of the data are given in Appendix A.

3.3   Because of the different age definitions used by insurers, adjustments were made to the data submitted by insurers to standardize the age definition with the resulting crude rate derived to be "age nearest birthday" basis.

3.4   As the volume of data for "medical" (i.e. medically underwritten) lives was relatively small and contained only lives that were of non-substandard underwriting status, the Workgroup decided to combine this category with the "non-medical" category. Possible reasons for requiring medical underwriting include old age at application, a large sum assured, and disclosure of medical impairments or an adverse family medical history. The Workgroup noted that the medical lives data contained a disproportionately high exposure to lives of older ages which may distort the comparison of mortality rates between medical and non-medical lives. However, due to the sparse data on medical lives, the Workgroup was unable to carry out any tests to establish any meaningful conclusions.

3.5   In addition, the Workgroup also decided to combine the curtate durations "2" to "5 and above" into "2 and above". Both of these adjustments are consistent with those adopted in previous mortality investigations. A summary of the experience split by curtate duration is available in Appendix B. From the summary, there do not seem to be major differences in the mortality experience of those with curtate durations "2 and above" and "5 and above" for the male insured lives. For female insured lives, there are small differences but these are not large enough to justify a separate analysis and graduation based on the curtate duration "5 and above" data.

3.6   Data verification for the experience analysis and graduation was conducted with the help of the MAS and was restricted to high-level reasonableness checks for each insurer as follows:

(a)   Set 3 data is a subset of Set 2 data: Number of inforce policies and deaths at each age in Set 3 should not exceed that in Set 2.

(b)   Number of inforce policies with duration t in year k is a subset of the number of inforce policies with duration t-1 in year k-1: Some marginal

differences were considered acceptable for this in view of the different possible policy movements, e.g. Reinstatements.

(c)   Exposure and deaths in each year progress smoothly from one year to the next.

(d)   The differences between the crude rates derived for all policies and those derived for policies that do not have 100% acceleration critical illness benefits looked reasonable.

(e)   Mortality improvements and specific mortality patterns, e.g. accident hump, were broadly consistent with those observed in the general population.

3.7   Policies with 100% acceleration critical illness benefits terminate upon the payment of critical illness benefit so that any deaths subsequent to diagnosis of a critical illness would not be recorded in the mortality investigation data. Hence, using the first two sets of data, which include policies with 100% acceleration critical illness benefits, would understate the underlying mortality experience. To overcome this, the Workgroup adopted the approach of excluding policies with 100% acceleration critical illness benefits from the data to be used in determining mortality rates.

3.8   As the information on policies with 100% acceleration critical illness benefits was only available for the top four insurers, the Workgroup derived the data to be used for mortality analysis by subtracting the in force policies and deaths in data Set 3 from Set 2. The Workgroup believes that this set of data, despite only including information from the four largest insurers, is broadly representative of the overall industry-wide experience based on the following observations:

(a)   The four largest insurers contributed more than 90%[2] of total exposure, and

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[2] This percentage was derived after the data was cleaned of irregularities, summed over the 5 years study period. Majority of the irregularities occurred in years prior to 2001. For year 2002, exposure of four largest insurers represents 89.7% of the overall industry exposure.

(b) The industry experience based on data from Set 1 was not significantly different from the experience of the four largest insurers based on data from Set 2, as shown in Tables 1 & 2 below:

Table 1: Chi-Square Test for Male Insured Lives

Age Range	Top 4 Insurers			All Companies		Chi Square Statistic[4]
	Exposure[3] (1)	No of Deaths (2)	Crude Rate per Mille (3)	Crude Rate per Mille (4)	Expected No of Deaths (4) x (1)	
15 - 19	274,384	61	0.22232	0.24601	67	0.626
20 - 24	366,873	167	0.45520	0.47426	174	0.281
25 - 29	604,036	261	0.43209	0.46898	283	1.753
30 - 34	799,673	274	0.34264	0.35259	282	0.224
35 - 39	926,576	543	0.58603	0.59948	555	0.280
40 - 44	870,070	756	0.86890	0.91372	795	1.915
45 - 49	669,155	846	1.26428	1.26352	845	0.000
50 - 54	391,727	908	2.31794	2.27489	891	0.320
Total	4,902,493	3,816			3,894	5.400
					P-Value	0.611

Table 2: Chi Square Test for Female Insured Lives

Age Range	Top 4 Insurers			All Companies		Chi Square Statistic
	Exposure (1)	No of Deaths (2)	Crude Rate per Mille (3)	Crude Rate per Mille (4)	Expected No of Deaths (4) x (1)	
15 - 19	228,531	29	0.12690	0.13092	30	0.028
20 - 24	352,023	55	0.15624	0.16078	57	0.045
25 - 29	701,999	133	0.18946	0.18448	130	0.094
30 - 34	870,656	232	0.26647	0.26594	232	0.001
35 - 39	920,130	348	0.37821	0.38376	353	0.074
40 - 44	827,544	409	0.49423	0.51718	428	0.843
45 - 49	606,913	547	0.90128	0.90270	548	0.001
50 - 54	356,297	462	1.29667	1.28890	459	0.017
Total	4,864,092	2,215			2,236	1.103
					P-Value	0.993

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[3] Exposure = 0.5 x (P_{97} + P_{02}) + P_{98} + P_{99} + P_{00} + P_{01}

[4] All chi-square tests are carried out by comparing actual versus expected death for the n age groupings. The P-Value is based on a chi-square test of n-1 degree of freedom.

3.9   With the above adjustments, the Workgroup derived crude rates to be used for establishing graduated mortality tables for male and female lives as shown in Appendix A. A summary of the data[5] used is tabulated below:

Table 3: Summary of the Data (Includes all ages, duration 2 and above, for top 4 insurers only)

Year	Males			Females		
	Inforce at 31 December -	Contribution to Exposure	Deaths During -	Inforce at 31 December -	Contribution to Exposure	Deaths During -
1997	804,823	402,412	-	708,215	354,108	-
1998	894,876	894,876	782	792,501	792,501	425
1999	987,411	987,411	827	874,249	874,249	477
2000	1,035,989	1,035,989	881	926,524	926,524	519
2001	1,041,596	1,041,596	987	933,933	933,933	584
2002	1,115,075	557,538	1,144	1,033,387	516,694	623
Total	5,879,770	4,919,821	4,621	5,268,809	4,398,008	2,628

3.10   It is worth noting that the analysis was based on number of policies rather than number of lives, so that a single life with multiple policies would be counted more than once in the exposure and claims data. The Workgroup was also unable to analyze mortality experience by size of sum assured as this information was not available from the data.

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[5] Detailed breakdown by age group, gender, medical status and policy duration can be found in Appendix B.

4 METHOD OF GRADUATION

4.1 The objective of graduation is to derive mortality rates that satisfy the dual criteria of providing a good fit to the underlying crude rates as well as ensuring the appropriateness of the overall shape and smoothness of the derived mortality curves.

4.2 The Free Cubic Spline (FCS) method was the primary method used for ages up to age 64. The Workgroup also experimented with two other methods, namely Whittaker-Henderson and Natural Cubic Spline. The FCS was found to exhibit better smoothness than Whittaker-Henderson and better fit than Natural Cubic Spline graduation. The overall shape was also considered to be more desirable from the Workgroup's perspective.

4.3 Adjustments were made using other methods such as a 7-year moving average and hand polishing to ensure smoothness and goodness of fit. The Gompertz formula was used for ages 65 and above.

4.4 For female lives:

(a) Age between 15 and 29: FCS rates with hand polishing. The crude rates at this age range were quite bumpy. However, the FCS rates, despite progressing smoothly from one age to the next, seemed to be low compared to the population mortality. The rates were therefore increased slightly by hand polishing to account for this.

(b) Age between 30 and 64: FCS rates were adopted.

(c) Age 65 and above: A weighted average of the rates derived by the Gompertz's formula and the FCS rates were used. The weights were as follows:

Table 4: Weighting of Gompertz's Formula and FCS Rates

Age	Weighting of Gompertz's Formula Rates	Weighting of FCS Rates[6]
65	0.0023	0.9977
66	0.0092	0.9908
67	0.0297	0.9703
68	0.0786	0.9214
69	0.1729	0.8271
70	0.3187	0.6813
71	0.5000	0.5000
72	0.6813	0.3187
73	0.8271	0.1729
74	0.9214	0.0786
75	0.9703	0.0297
76	0.9908	0.0092
77	0.9977	0.0023
78 and above	1.0000	0.0000

The Gompertz's formula is as follows:

$$q_x = 1 - \exp(-\mu_x)$$

where x is age and μ_x is defined by the following regression equation:

$$Log_e\mu_x = a + bx$$

As data for ages 65 and above were relatively scanty, we used regression techniques based on the data over the age range of 55 to 75 to fit the Gompertz parameters. The coefficients and the regression statistics are as tabulated below:

	Coefficients	Standard Error	t Stat	P-value
a	-12.8481	0.693697	-18.5212	1.28E-13
b	0.119394	0.010626	11.2358	7.81E-10

Using the formula derived from the regression, we performed the goodness of fit test over the age range of 65 to 85, which gave a p-value of 73.54%.

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[6] Beyond age 75, FCS rates are taken as zero since our initial graduation using FCS method is for the age range of 10 to 75.

4.5   For male lives:

(a)   Age between 15 and 18: A weighted average of the FCS rates and 7 year moving average (7 year MA) rates was taken to form the graduated rates.

Table 5: Weighting of FCS and 7 Year MA Rates

Age	Weighting of FCS Rates	Weighting of 7 Year MA Rates
15	0.6813	0.3187
16	0.8271	0.1729
17	0.9214	0.0786
18	0.9703	0.0297

(b)   Age between 19 and 23: The crude rates indicated the existence of an "accident hump" peaking at age 21. Hand polishing was used to establish the graduated rates reflecting the hump.

(c)   Age between 24 and 29: The crude rates indicated a mild hump from ages 26 to 29. The Workgroup was of the view there is no strong reason why a mortality hump should exist for this age range and noted that such a hump was not observed in previous mortality investigations, nor in other mortality tables around the world. Linear interpolation based on the graduated rates at ages 23 and 30 was adopted to smooth out the hump and derive graduated rates for this age range. The Workgroup recommends further investigation to be conducted for this age range in the future mortality reviews.

(d)   Age between 30 and 50: FCS rates with slight adjustments, loading the FCS rates by no more than 1%. This loading was to narrow the gap between the observed and expected deaths in the insured population studied. As this is the main age range for insured lives, the Workgroup was wary of underestimating the mortality rates in these ages.

(e)   Age between 51 and 64: FCS rates

(f)   Age 65 and above: A weighted average of the rates derived by the Gompertz's formula and the FCS rates were used. The weights were as follows:

Table 6: Weighting of Gompertz's Formula and FCS Rates

Age	Weighting of Gompertz's Formula Rates	Weighting of FCS Rates[7]
65	0.0023	0.9977
66	0.0092	0.9908
67	0.0297	0.9703
68	0.0786	0.9214
69	0.1729	0.8271
70	0.3187	0.6813
71	0.5000	0.5000
72	0.6813	0.3187
73	0.8271	0.1729
74	0.9214	0.0786
75	0.9703	0.0297
76	0.9908	0.0092
77	0.9977	0.0023
78 and above	1.0000	0.0000

The Gompertz's formula is as follows:

$$q_x = 1 - \exp(-\mu_x)$$

where age is represented by the variable x, and μ_x is defined by the following regression equation:

$$Log_e \mu_x = a + bx$$

Following the same approach for female lives, regression techniques were used to fit the Gompertz parameters based on the data over the age range of 55 to 80. The coefficients and regression statistics were as tabulated below:

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[7] Beyond age 75, FCS rates were taken as zero since our initial graduation using FCS method was for the age range of 10 to 75.

	Coefficients	Standard Error	t Stat	P-value
A	-11.329	0.53613	-21.131	5.12E-17
B	0.10399	0.007894	13.17313	1.77E-12

This regression gave a p-value of 0.40% for the goodness of fit test over the age range of 65 to 85. Although this indicates a poor fit, the Workgroup felt that the graduated rates provided a reasonable representation of mortality experience at the older ages.

4.6   The following table summarizes the methodologies used for graduation of the mortality rates for male and female insured lives over the various age ranges:

Table 7: Summary of Graduation Methods

Age	Males	Age	Females
15 – 18	K(FCS q) + (1-K) (7 yr MA q)	15 – 29	Handpolishing
19 – 23	Hand polishing	30 – 64	FCS q
24 – 29	Linear interpolation b/w q of 23 and 30	65 – 78	K (Gompertz's q) + (1-K) (FCS q)
30 – 50	K (FCS q)	79 – 99	Gompertz's q
51 – 64	FCS q		
65 – 78	K (Gompertz's q) + (1-K) (FCS q)		
79 – 99	Gompertz's q		

4.7   Based on the data available, we were unable to derive credible mortality rates for children aged below 15. The data was scanty due to and the small number of deaths occurring at these ages. The experience also varied considerably from year to year and from company to company. We held the view that errors and distortions in the data or differences in company practices could have a much more severe impact on the mortality rates for ages below 15 compared to that at other ages. As such, our final mortality table only covers the ages 15 – 99.

5 GRADUATED TABLES

The graduated rates resulting from the graduation described in section 3 above are tabulated below:

Table 8: Graduated Rates Per Mille for Singapore Mortality Assured lives experience 1997 – 2003 (S9702)

Age Nearest Birthday	Males	Females	Age Nearest Birthday	Males	Females
15	0.1662	0.1535	58	4.7864	2.9105
16	0.2038	0.1570	59	5.3584	3.1716
17	0.2503	0.1658	60	5.9895	3.4507
18	0.2974	0.1767	61	6.6878	3.7484
19	0.3804	0.1861	62	7.4809	4.0655
20	0.4692	0.1876	63	8.4011	4.4026
21	0.5402	0.1885	64	9.4809	4.7700
22	0.5344	0.1894	65	10.7515	5.2189
23	0.5058	0.1904	66	12.2409	5.8119
24	0.4891	0.1919	67	13.9616	6.6195
25	0.4725	0.1939	68	15.8862	7.7127
26	0.4559	0.2046	69	17.9177	9.1330
27	0.4394	0.2171	70	19.8969	10.8417
28	0.4230	0.2317	71	21.6888	12.7053
29	0.4067	0.2488	72	23.3060	14.5726
30	0.4066	0.2678	73	24.9440	16.3981
31	0.4011	0.2892	74	26.8669	18.3032
32	0.4060	0.3103	75	29.2517	20.4436
33	0.4201	0.3318	76	31.7079	22.4868
34	0.4456	0.3544	77	35.3640	25.4772
35	0.4843	0.3787	78	39.2543	28.7284
36	0.5373	0.4054	79	43.4614	32.3121
37	0.6020	0.4350	80	48.1079	36.3345
38	0.6743	0.4684	81	53.2372	40.8469
39	0.7505	0.5061	82	58.8964	45.9062
40	0.8269	0.5487	83	65.1361	51.5751
41	0.9007	0.5970	84	72.0112	57.9226
42	0.9741	0.6515	85	79.5806	65.0241
43	1.0504	0.7130	86	87.9073	72.9621
44	1.1330	0.7821	87	97.0583	81.8261
45	1.2251	0.8594	88	107.1048	91.7125
46	1.3300	0.9456	89	118.1215	102.7252
47	1.4511	1.0413	90	130.1866	114.9746
48	1.5916	1.1472	91	143.3807	128.5771
49	1.7549	1.2640	92	157.7866	143.6543
50	1.9443	1.3923	93	173.4879	160.3311
51	2.1588	1.5327	94	190.5676	178.7339
52	2.4098	1.6859	95	209.1062	198.9876
53	2.6968	1.8525	96	229.1799	221.2118
54	3.0230	2.0333	97	250.8578	245.5165
55	3.3917	2.2288	98	274.1985	271.9956
56	3.8063	2.4398	99	299.2470	300.7207
57	4.2701	2.6668			

Graph plots against the crude rates are in Appendix E.

6 FIT AND SMOOTHNESS

6.1 As an overall reasonableness check of the graduated rates, we tabulated the actual deaths against the expected deaths based on the final graduated rates for different age ranges.

Table 9: Comparison of Expected Deaths Against Actual Deaths

Age	Males			Females		
	Actual (A)	Expected (E)	Ratio (A/E)	Actual (A)	Expected (E)	Ratio (A/E)
15 - 24	174	202	86%	70	80	88%
25 - 34	440	451	97%	302	300	101%
35 - 44	1140	1111	103%	652	680	96%
45 - 54	1580	1578	100%	895	883	101%
55 - 64	787	819	96%	457	450	101%
65 - 80	404	376	107%	177	174	101%
15 - 90	4551	4563	100%	2563	2579	99%
25 - 54	3160	3140	101%	1849	1863	99%
55 - 80	1191	1195	100%	634	625	101%

6.2 The table below summarizes the results of the smoothness test[8] that we performed on the graduated table:

Table 10: Results of Smoothness Test

Age	Males			Females		
	Sum of 3rd Difference	No of negative signs for (3rd difference - q_x/343)	Sum of (3rd difference - $(q_{x+1}/q_x$ - 1)^3 x q_x)	Sum of 3rd Difference	No of negative signs for (3rd difference - q_x/343)	Sum of (3rd difference - $(q_{x+1}/q_x$ - 1)^3 x q_x)
15 - 24	0.0000028	4	0.0000000	-0.0000049	6	0.0000000
25 - 34	-0.0000005	7	0.0000000	0.0000006	9	0.0000000
35 - 44	-0.0000050	7	0.0000000	0.0000065	10	0.0000000
45 - 54	0.0000330	9	0.0000000	0.0000065	10	0.0000000
55 - 64	0.0001203	7	0.0000000	0.0000162	10	0.0000000
65 - 80	0.0002800	12	-0.0000006	0.0004083	7	-0.0000007
15 - 90	0.0010393	56	-0.0000017	0.0012314	62	-0.0000022
25 - 54	0.0000274	23	0.0000000	0.0000137	29	0.0000000
55 - 80	0.0004002	19	-0.0000006	0.0004245	17	-0.0000007

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[8] Some criteria for smoothness are detailed in Appendix F.

6.3   Based on Barnett's rule of thumb for smoothness,

(a)   For male lives, the graduated table satisfies the inequality of { (3rd order differences of q_x - q_x/343) < 0 } for 79% of the ages. Second order differences of q_x changed signs at age 22, 23, 70 and 73.

(b)   For female lives, the graduated table satisfies the same inequality for 87% of the ages. Second order differences of q_x changed signs at age 76 and 77.

6.4   The results of the smoothness test indicated that the graduated rates exhibited a reasonable level of smoothness. Although there were slight deviations from expected results, the Workgroup considered the smoothness of this graduation to be satisfactory.

6.5   A chi-squared goodness of fit test based on grouped age ranges was also performed. The results are tabulated below:

Table 11: Chi-Square Test on Grouped Age Ranges

Age	Males			Females		
	Actual Deaths	Expected Deaths	Chi-Sq Contribution	Actual Deaths	Expected Deaths	Chi-Sq Contribution
15 – 24	174	202	3.9904	70	80	1.2030
25 – 34	440	451	0.2923	302	300	0.0156
35 – 44	1140	1111	0.7412	652	680	1.1686
45 – 54	1580	1578	0.0034	895	883	0.1514
55 – 64	787	819	1.2530	457	450	0.1003
65 – 74	353	323	2.8598	151	147	0.0854
75 – 99	79	82	0.1384	37	38	0.0544
25 – 54	P-Value		0.5954			0.5129
15 – 99	P-Value		0.1585			0.8361

6.6   The goodness of fit test based on the age ranges defined above indicated that the graduated rates exhibited a reasonable level of fit to the crude data.

6.7   The Workgroup noted the following while performing the graduation:

(a)   Accident hump: for the male table, the raw mortality data exhibited 2 humps – at ages 21 and 28 respectively. These were reasonably consistent across different years. As mentioned earlier, the Workgroup decided to smooth out the hump at age 28.

(b)   Multiple policies: the chi-square test assumes that claims in a particular cell are independent of one another. However, as noted earlier, this study was conducted based on number of policies and not number of lives so that the assumption of independence may not be entirely valid.

7 GENERAL OBSERVATIONS

7.1 We compared the S9702 graduated rates with the graduated rates of S8388 and S8893. Both the earlier tables are based on insured lives for policies with curtate duration 2 and above. As these tables were based on age nearest birthday, the rates were adjusted for the purpose of this comparison.

7.2 Graphs comparing the S9702 graduated rates with S8388 and S8893 are in Appendix D.

7.3 The implied life expectancies for the different tables were derived as follows:

Table 12: Life Expectancy at Different Ages

Age Nearest Birthday	Males			Females		
	S8388	S8893	S9702	S8388	S8893	S9702
15	76.16	79.01	81.23	81.83	83.88	84.57
30	76.73	79.54	81.58	82.06	84.12	84.75
40	77.06	79.80	81.82	82.33	84.30	84.94
50	77.69	80.31	82.27	82.73	84.70	85.28
60	79.29	81.52	83.20	83.78	85.35	85.95
65	80.55	82.62	84.02	84.73	86.12	86.44
70	82.18	84.06	85.26	85.97	87.29	87.11

7.4 Mortality Improvements of Insured Lives

    (a) Tabulated below are the mortality rates for various age groups weighted by the exposure data used in this study at the individual ages[9]:

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[9] This is based on the graduated rates of the individual tables. The crude data for S8388 and S8893 was not taken into account. For S9702, which is the proposed graduated table, the exposure data was used as weights to derive the average mortality rates for each age group.

Table 13: Rates per Mille Weighted by Exposure

Age Nearest Birthday	Males			Females		
	S8388	S8893	S9702	S8388	S8893	S9702
15 - 19	0.6637	0.4788	0.2552	0.2233	0.1683	0.1670
20 - 24	0.7532	0.7710	0.5076	0.2608	0.3282	0.1899
25 - 29	0.6319	0.5824	0.4375	0.2903	0.2770	0.2209
30 - 34	0.6096	0.4754	0.4170	0.4617	0.3118	0.3126
35 - 39	0.9801	0.6912	0.6107	0.6913	0.4453	0.4381
40 - 44	1.5974	1.1312	0.9735	0.7995	0.7259	0.6542
45 - 49	2.3167	1.7739	1.4532	1.3410	1.2568	1.0354
50 - 54	4.5037	3.0448	2.3552	2.5032	1.8081	1.6469
55 - 59	8.7239	6.0500	4.1668	4.7822	2.4209	2.6232
60 - 64	13.6870	10.5649	7.2623	8.2031	6.1526	3.9519
65 - 69	21.6509	16.9736	13.4021	12.9048	11.3039	6.4364
70 - 99	45.7034	35.3731	28.5166	26.0651	22.1376	17.6782
25 - 54	1.5605	1.1382	0.9376	0.8505	0.6791	0.6094
15 - 99	1.9484	1.4427	1.1282	1.0638	0.8199	0.7032

(b) Based on the above, the implied annualized improvement in mortality for each age group are as follows:

Table 14: Annualized Mortality Improvements

Age Nearest Birthday	Males			Females		
	5 Years from S8388 to S8893	9 Years from S8893 to S9702	14 Years from S8388 to S9702	5 Years from S8388 to S8893	9 Years from S8893 to S9702	14 Years from S8388 to S9702
15 - 19	6.32%	6.75%	6.60%	5.50%	0.09%	2.06%
20 - 24	-0.47%	4.54%	2.78%	-4.70%	5.90%	2.24%
25 - 29	1.62%	3.13%	2.59%	0.93%	2.48%	1.93%
30 - 34	4.85%	1.45%	2.68%	7.55%	-0.03%	2.75%
35 - 39	6.75%	1.37%	3.32%	8.42%	0.18%	3.21%
40 - 44	6.67%	1.65%	3.48%	1.91%	1.15%	1.42%
45 - 49	5.20%	2.19%	3.28%	1.29%	2.13%	1.83%
50 - 54	7.53%	2.81%	4.52%	6.30%	1.03%	2.95%
55 - 59	7.06%	4.06%	5.14%	12.73%	-0.90%	4.20%
60 - 64	5.05%	4.08%	4.43%	5.59%	4.80%	5.08%
65 - 69	4.75%	2.59%	3.37%	2.61%	6.07%	4.85%
70 - 99	5.00%	2.37%	3.31%	3.21%	2.47%	2.74%
25 - 54	6.12%	2.13%	3.57%	4.40%	1.20%	2.35%
15 - 99	5.83%	2.69%	3.83%	5.08%	1.69%	2.91%

(c) For male insured lives, the most significant improvements in mortality compared to the previous published table, S8893, were in the age

ranges of 15 – 24 and 55 – 64. The significant improvements compared to the S8388 table were in the age ranges of 15 – 19 and 50 – 64.

(d)   For female insured lives, the most significant improvements in mortality compared to the previous published table, S8893, were in the age ranges of 20 – 24 and 60 – 69. The significant improvements compared to the S8388 table were in the age ranges of 55 – 69.

7.5   Comparison with Population Mortality

(a)   At the point of conducting this study, the most recent population statistics that were available were those relevant up to 2001. Hence, even though the proposed graduated table was based on the mortality experience of insured lives during the 5 years from 1998 to 2002, comparisons have been made with the population mortality during the 4 years from 1998 to 2001.

(b)   Population mortality rates of Singapore residents based on the "Yearbook of Statistics, Singapore" averaged across the relevant years are shown in the following table:

Table 15: Estimated Population Mortality Rates per Mille

Age	Males			Females		
	1984-1988	1989-1993	1998-2001	1984-1988	1989-1993	1998-2001
15-19	0.7600	0.5200	0.3750	0.3800	0.2800	0.2750
20-24	1.0600	0.7600	0.6750	0.4600	0.3800	0.2250
25-29	1.1400	0.6000	0.6250	0.6000	0.4200	0.3000
30-34	1.2600	0.9000	0.7500	0.7800	0.5600	0.4500
35-39	1.8800	1.2200	1.1000	1.1000	0.8400	0.6250
40-44	2.8800	2.1000	1.7000	1.6400	1.4600	0.9750
45-49	4.7200	3.6400	2.6250	2.8200	2.1800	1.7000
50-54	8.7800	6.7600	4.6000	5.0000	3.9400	2.7750
55-59	15.4600	12.0400	8.3250	7.9600	6.7600	4.7000
60-64	23.5800	20.3800	14.8750	13.6600	11.0400	8.2750
65-69	36.2800	30.7800	24.7750	21.7800	18.3400	14.6250

(c)   Expressing the S9702 insured mortality rates as a percentage of the estimated population mortality rates gives the following table:

Table 16: Insured Mortality as Percentage of Population Mortality

Age	Males			Females		
	1983 - 1988	1988 - 1993	1997 – 2002/01	1983 - 1988	1988 - 1993	1997 – 2002/01
15-19	90%	98%	68%	60%	67%	61%
20-24	70%	101%	75%	57%	86%	84%
25-29	55%	93%	70%	50%	65%	74%
30-34	50%	54%	56%	62%	58%	69%
35-39	56%	60%	56%	64%	55%	70%
40-44	57%	56%	57%	50%	53%	67%
45-49	52%	51%	55%	51%	61%	61%
50-54	56%	48%	51%	53%	46%	59%
55-59	59%	54%	50%	64%	39%	56%
60-64	61%	54%	49%	63%	60%	48%
65-69	63%	58%	54%	62%	65%	44%

(d)   It was observed that while the ratios of insured to population mortality for males have remained relatively stable for the three graduated insured lives tables, the corresponding ratios for female lives have increased for the most recent S9702 graduated table.

(e)   While some of the variations in mortality between different time periods may have been due to changes in the composition of the insured life population (e.g. smoker status, marriage status, medical history, etc), the Workgroup, was unable to analyze these factors due to the lack of relevant data.

(f)   The implied mortality improvements based on the estimated population mortality in the various study periods are as follows:

Table 17: Mortality Improvements of Singapore Residents

Age	Males			Females		
	5 Years from 8388 to 8893	9 Years from 8893 to 9701	14 Years from 8388 to 9701	5 Years from 8388 to 8893	9 Years from 8893 to 9701	14 Years from 8388 to 9701
15-19	7.31%	3.57%	4.92%	5.92%	0.20%	2.28%
20-24	6.44%	1.31%	3.17%	3.75%	5.66%	4.98%
25-29	12.05%	-0.45%	4.20%	6.89%	3.67%	4.83%
30-34	6.51%	2.01%	3.64%	6.41%	2.40%	3.85%
35-39	8.28%	1.14%	3.76%	5.25%	3.23%	3.96%
40-44	6.12%	2.32%	3.70%	2.30%	4.39%	3.65%
45-49	5.06%	3.57%	4.10%	5.02%	2.73%	3.55%
50-54	5.09%	4.19%	4.51%	4.65%	3.82%	4.12%
55-59	4.88%	4.02%	4.33%	3.22%	3.96%	3.69%
60-64	2.87%	3.44%	3.24%	4.17%	3.15%	3.52%
65-69	3.23%	2.38%	2.69%	3.38%	2.48%	2.80%

(g)   The mortality improvements observed in the population are reasonably consistent with the improvements observed in the three graduated mortality tables S8388, S8893 and S9702.

8   AREAS FOR FUTURE RESEARCH

8.1   Due to limitations in the data available, the mortality study was based on number of policies inforce and terminated by death. It may be more accurate to perform the study based on number of lives inforce and dying during the study period. This would avoid distortions arising from lives with multiple policies. It is acknowledged however, that an analysis based on lives as opposed to policies would pose significantly more problems due to difficulties associated with matching multiple policies to a single life, especially across different insurance companies.

8.2   In this study, the Workgroup could not have access to data split by smokers and non-smokers because the statutory requirement under MAS Notice 303 for mortality data submitted to the MAS does not require such detailed breakdown.. The Workgroup understands that the life insurance companies do typically record the smoking status of lives at policy inception, at least for policies written in recent years. To properly allow for the impact of changes in the relative proportions of smokers and non-smokers on the overall mortality experience, the Workgroup believes that it would be useful to perform further studies based on data segregated by smoking status, recognizing the definition of smoker tend to vary among insurance companies.

8.3   The Workgroup noted differences in insurance companies' practices with respect to the inclusion of investment-linked policies in the data provided for the investigation. In view of the irregular movements (e.g. top-ups, premium holidays, etc) and simplified underwriting associated with these policies, the Workgroup would prefer that future studies be based on traditional whole life and endowment policies only.

8.4   As mentioned in the previous sections, the Workgroup noted a second mortality hump for male lives in the late twenties. This hump was deemed to be significant, though less prominent than the hump at age 21, and possibly

consistent with the experience of the general population. The Workgroup is of the view that this should be investigated further to ascertain whether this is merely a statistical fluctuation or whether it is a genuine feature of the mortality of insured males in Singapore.

8.5 As the exposure in respect of policies with critical illness coverage has increased significantly over recent years, the Workgroup is of the view that it should be possible to do a study on critical illness claims experience. This could be based on acceleration benefits as well as additional or standalone critical illness benefits.

9 APPENDIX A: CRUDE RATES

9.1 Format of Data

For sets 1 and 2 of data:

Gender Status Underwriting Status	Males							Females						
Medical	Age / Duration	0	1	2	3	4	5 and above	Age / Duration	0	1	2	3	4	5 and above
	1 2 3 . . . 99			Number of policies				1 2 3 . . . 99			Number of policies			
Non-Medical	Age / Duration	0	1	2	3	4	5 and above	Age / Duration	0	1	2	3	4	5 and above
	1 2 3 . . . 99			Number of policies				1 2 3 . . . 99			Number of policies			

For set 3 data:

Gender Status Underwriting Status	Males							Females						
Combined Medical and Non-Medical	Age Last Birthday / Duration	0	1	2	3	4	5 and above	Age Last Birthday / Duration	0	1	2	3	4	5 and above
	1 2 3 . . . 99			Number of policies				1 2 3 . . . 99			Number of policies			

9.2 Crude Rates used for derivation of S9702

Table 18: Exposure Data and Crude Rates per Mille

Age Nearest Birthday	Males Exposure	Males Crude Rate	Females Exposure	Females Crude Rate	Age Nearest Birthday	Males Exposure	Males Crude Rate	Females Exposure	Females Crude Rate
15	50,963	0.1962	42,067	0.0951	58	18,836	4.3004	17,415	2.4117
16	49,012	0.1632	39,983	0.1501	59	15,963	7.2044	15,306	3.0707
17	46,569	0.1933	37,912	0.1846	60	13,658	5.1986	13,524	2.6620
18	44,411	0.3378	35,505	0.1408	61	11,763	6.2909	11,659	3.9454
19	43,158	0.2317	34,983	0.0858	62	9,788	8.8889	9,546	4.8190
20	43,914	0.4099	36,331	0.0551	63	7,629	6.5544	7,383	4.4697
21	48,549	0.7415	40,315	0.1488	64	6,000	8.0000	5,794	3.6244
22	55,888	0.3579	49,310	0.2028	65	4,703	10.4200	4,536	6.1735
23	63,811	0.4075	57,434	0.2438	66	3,862	14.2432	3,609	5.5425
24	68,916	0.3192	69,323	0.1875	67	3,104	16.7553	2,733	3.2931
25	77,715	0.3474	81,816	0.1833	68	2,481	10.4796	2,090	9.5694
26	85,897	0.3842	91,488	0.2077	69	2,004	22.9541	1,709	9.3649
27	92,542	0.5835	98,685	0.1925	70	1,472	25.1444	1,206	13.2670
28	96,801	0.5578	103,180	0.1551	71	1,159	19.8447	939	11.7146
29	99,994	0.4400	105,862	0.2834	72	897	23.4114	747	14.7354
30	103,354	0.4934	108,668	0.2853	73	680	36.7918	564	15.9574
31	116,588	0.3002	122,308	0.0981	74	517	36.7861	430	25.6112
32	122,936	0.3254	126,000	0.3413	75	408	36.7647	345	28.9855
33	129,358	0.3401	129,574	0.5557	76	343	43.7318	250	8.0000
34	135,282	0.4287	132,673	0.3392	77	275	25.5009	192	26.1097
35	139,732	0.5081	133,936	0.2987	78	203	24.6305	132	38.0228
36	142,748	0.5324	134,374	0.4540	79	156	38.5852	95	31.5789
37	144,917	0.6279	133,383	0.4873	80	124	24.1935	73	13.7931
38	145,259	0.8330	131,612	0.5547	81	94	53.1915	57	35.0877
39	144,399	0.7964	129,181	0.4258	82	72	13.9860	40	50.6329
40	143,567	0.5851	126,776	0.4812	83	56	125.0000	30	33.8983
41	142,242	0.8225	123,980	0.3791	84	38	133.3333	20	0.0000
42	139,273	1.1560	120,499	0.6971	85	25	240.0000	15	0.0000
43	135,836	1.0969	115,475	0.6408	86	17	0.0000	12	83.3333
44	130,795	1.1851	109,358	0.8413	87	15	66.6667	7	615.3846
45	123,634	1.2294	102,023	1.0194	88	15	0.0000	17	0.0000
46	117,484	1.0810	94,473	1.1114	89	17	0.0000	3	0.0000
47	110,674	1.4547	87,142	0.8836	90	10	105.2632	2	0.0000
48	102,826	1.5560	80,413	1.2063	91	9	0.0000	2	0.0000
49	95,108	1.5666	74,109	1.2954	92	6	333.3333	1	2000.0000
50	86,977	1.9660	68,193	1.2025	93	2	0.0000	0	0.0000
51	78,527	2.4068	61,578	1.6564	94	0	0.0000	0	0.0000
52	67,096	2.8616	52,974	1.6234	95	2	0.0000	0	0.0000
53	55,111	2.6311	43,654	2.2220	96	3	0.0000	0	0.0000
54	42,959	3.1193	34,556	1.4180	97	2	0.0000	0	0.0000
55	31,159	2.9526	26,276	2.2835	98	0	0.0000	0	0.0000
56	24,229	3.2606	21,139	3.2641	99	0	0.0000	0	0.0000
57	21,260	4.2334	19,347	2.9462					

10 APPENDIX B: SUMMARY OF DATA

Tables in this Appendix presents results of data analysis on Set 2 and 3 data as described in Section 3 of this report.

10.1 Male Insured Lives

Table 19: Data Split by Exposure[10] Year - Males

Age Group	1998 Exposure	1998 Deaths	1998 Crude Rate	1999 Exposure	1999 Deaths	1999 Crude Rate	2000 Exposure	2000 Deaths	2000 Crude Rate	2001 Exposure	2001 Deaths	2001 Crude Rate	2002 Exposure	2002 Deaths	2002 Crude Rate	Total Exposure	Total Deaths	Total Crude Rate
15 - 19	39,162	8	0.2043	43,846	12	0.2737	47,593	6	0.1261	50,648	21	0.4146	52,865	5	0.0946	234,112	52	0.2221
20 - 24	54,056	19	0.3515	55,621	21	0.3776	57,525	33	0.5737	57,132	28	0.4901	56,744	21	0.3701	281,078	122	0.4340
25 - 29	90,801	27	0.2974	96,335	42	0.4360	99,102	48	0.4844	84,585	39	0.4611	82,126	56	0.6819	452,947	212	0.4680
30 - 34	112,906	54	0.4783	121,379	39	0.3213	127,363	48	0.3769	123,599	42	0.3398	122,271	45	0.3680	607,517	228	0.3753
35 - 39	122,663	81	0.6603	137,116	93	0.6783	148,459	92	0.6197	152,876	91	0.5953	155,941	117	0.7503	717,054	474	0.6610
40 - 44	115,666	139	1.2017	130,150	116	0.8913	141,019	136	0.9644	148,662	145	0.9754	156,217	130	0.8322	691,712	666	0.9628
45 - 49	87,191	129	1.4795	100,050	134	1.3393	111,100	151	1.3591	120,545	148	1.2278	130,841	187	1.4292	549,726	749	1.3625
50 - 54	42,888	121	2.8213	54,179	139	2.5656	66,127	151	2.2835	78,271	176	2.2486	89,205	244	2.7353	330,669	831	2.5131
55 - 59	17,169	60	3.4948	19,173	80	4.1725	20,874	86	4.1201	23,996	94	3.9174	30,235	137	4.5312	111,445	457	4.1007
60 - 64	6,644	53	7.9771	7,992	66	8.2583	9,641	41	4.2529	11,536	89	7.7153	13,025	81	6.2190	48,837	330	6.7572
65 - 69	2,348	29	12.3536	2,680	37	13.8060	3,107	48	15.4490	3,728	53	14.2186	4,291	61	14.2175	16,153	228	14.1155
70 - 99	951	44	46.2914	1,107	32	28.9070	1,292	30	23.2198	1,505	48	31.9043	1,757	50	28.4576	6,611	204	30.8577
All	**692,441**	**764**	**1.1033**	**769,626**	**811**	**1.0538**	**833,198**	**870**	**1.0442**	**857,079**	**974**	**1.1364**	**895,515**	**1,134**	**1.2663**	**4,047,858**	**4,553**	**1.1248**

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[10] Exposure for year t = 0.5 x [Inforce policies (t-1) + Inforce policies (t)]
Total exposure for study period = Sum (Exposure 1998 to 2002) = 0.5 x (P_{97} + P_{02}) + P_{98} + P_{99} + P_{00} + P_{01}
Where P_t is the number of inforce policies at the end of year t

Table 20: Data for Male Insured Lives

Age	Medical Lives			Non-Medical Lives			Total		
Group	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate
15 - 19	18,602	5	0.2688	255,782	56	0.2189	274,384	61	0.2223
20 - 24	20,401	11	0.5392	346,473	156	0.4503	366,873	167	0.4552
25 - 29	38,208	15	0.3926	565,829	246	0.4348	604,036	261	0.4321
30 - 34	62,883	24	0.3817	736,790	250	0.3393	799,673	274	0.3426
35 - 39	91,479	63	0.6887	835,098	480	0.5748	926,576	543	0.5860
40 - 44	114,522	73	0.6374	755,549	683	0.9040	870,070	756	0.8689
45 - 49	113,061	119	1.0525	556,095	727	1.3073	669,155	846	1.2643
50 - 54	86,176	156	1.8103	305,551	752	2.4611	391,727	908	2.3179
55 - 59	45,442	137	3.0149	86,354	362	4.1921	131,795	499	3.7862
60 - 64	24,807	149	6.0064	30,670	204	6.6515	55,477	353	6.3630
65 - 69	10,027	138	13.7635	6,708	92	13.7150	16,735	230	13.7441
70 - 99	4,845	146	30.1373	1,774	58	32.7037	6,618	204	30.8250
All	**630,449**	**1,036**	**1.6433**	**4,482,669**	**4,066**	**0.9070**	**5,113,118**	**5,102**	**0.9978**

Table 21: Data – Duration 0, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	34,508	10	10	97%	0.2898	25,041	7	8	92%	0.2795
20 - 24	78,730	38	40	95%	0.4827	63,157	31	32	97%	0.4908
25 - 29	93,053	32	41	78%	0.3439	75,551	24	33	72%	0.3177
30 - 34	101,141	39	42	93%	0.3856	84,793	34	35	96%	0.4010
35 - 39	101,362	30	62	49%	0.2960	85,522	26	52	50%	0.3040
40 - 44	86,277	49	84	59%	0.5679	74,518	44	72	61%	0.5905
45 - 49	59,293	53	86	62%	0.8939	52,092	49	75	65%	0.9406
50 - 54	25,328	48	58	82%	1.8951	22,363	42	51	82%	1.8781
55 - 59	7,549	19	31	62%	2.5169	6,446	18	26	69%	2.7926
60 - 64	2,352	2	17	12%	0.8505	2,289	2	16	12%	0.8739
65 - 69	286	1	4	28%	3.4965	285	1	4	28%	3.5088
70 - 99	40	0	1	0%	0.0000	38	0	1	0%	0.0000
Total	589,917	321	475	68%	0.5441	492,092	278	406	68%	0.5649

Table 22: Data – Duration 1, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	26,248	9	7	122%	0.3429	17,494	8	5	162%	0.4573
20 - 24	73,907	30	38	80%	0.4059	57,134	24	29	83%	0.4201
25 - 29	83,399	28	37	76%	0.3357	63,956	23	28	82%	0.3596
30 - 34	94,046	37	39	94%	0.3934	75,255	32	31	102%	0.4252
35 - 39	96,848	46	59	78%	0.4750	78,354	41	48	86%	0.5233
40 - 44	81,213	64	79	81%	0.7881	66,876	59	65	91%	0.8822
45 - 49	55,551	70	80	87%	1.2601	46,463	61	67	91%	1.3129
50 - 54	25,575	59	59	100%	2.3070	21,755	52	50	104%	2.3903
55 - 59	7,346	15	30	50%	2.0421	5,846	13	24	54%	2.2237
60 - 64	2,574	12	18	66%	4.6620	2,328	9	17	54%	3.8668
65 - 69	445	6	6	108%	13.4983	445	6	6	108%	13.4983
70 - 99	52	0	1	0%	0.0000	50	0	1	0%	0.0000
Total	547,200	376	452	83%	0.6871	435,951	328	370	89%	0.7524

Table 23: Data – Duration 2, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	24,860	10	7	151%	0.4023	16,162	8	4	187%	0.4950
20 - 24	68,606	30	35	86%	0.4373	50,690	21	26	81%	0.4143
25 - 29	82,742	29	36	80%	0.3505	60,549	23	27	86%	0.3799
30 - 34	85,389	24	36	67%	0.2811	63,835	20	27	75%	0.3133
35 - 39	90,381	63	55	115%	0.6970	68,679	52	42	125%	0.7571
40 - 44	75,383	77	73	106%	1.0215	58,286	70	56	124%	1.2010
45 - 49	51,173	75	74	102%	1.4656	40,147	68	58	117%	1.6938
50 - 54	24,417	53	56	94%	2.1707	19,560	44	45	98%	2.2495
55 - 59	6,969	23	29	79%	3.3006	5,099	22	21	103%	4.3150
60 - 64	2,658	11	19	59%	4.1392	2,213	10	16	63%	4.5198
65 - 69	482	2	6	33%	4.1494	482	2	6	33%	4.1494
70 - 99	52	0	1	0%	0.0000	50	0	1	0%	0.0000
Total	513,108	397	427	93%	0.7737	385,750	340	329	103%	0.8814

Table 24: Data – Duration 3, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	25,969	5	7	73%	0.1925	17,479	4	5	88%	0.2289
20 - 24	64,184	26	33	79%	0.4051	45,851	18	23	77%	0.3926
25 - 29	86,319	33	38	87%	0.3823	61,730	22	27	81%	0.3564
30 - 34	85,290	38	36	107%	0.4455	60,773	29	25	115%	0.4772
35 - 39	92,036	49	56	88%	0.5324	67,243	40	41	98%	0.5949
40 - 44	78,343	69	76	91%	0.8807	58,661	60	57	106%	1.0228
45 - 49	54,952	67	79	84%	1.2193	42,045	59	61	97%	1.4033
50 - 54	27,071	57	63	91%	2.1056	21,020	47	49	97%	2.2360
55 - 59	7,384	18	31	58%	2.4379	5,202	13	22	59%	2.4993
60 - 64	2,636	13	19	70%	4.9317	2,017	10	14	69%	4.9579
65 - 69	476	2	6	32%	4.2061	475	2	6	32%	4.2105
70 - 99	32	0	1	0%	0.0000	31	0	1	0%	0.0000
Total	524,689	377	444	85%	0.7185	382,525	304	331	92%	0.7947

Table 25: Data – Duration 4, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	27,063	7	7	100%	0.2587	19,480	6	5	121%	0.3080
20 - 24	54,814	27	28	97%	0.4926	37,974	18	19	94%	0.4740
25 - 29	88,098	39	39	101%	0.4427	62,154	30	27	110%	0.4827
30 - 34	83,997	20	35	57%	0.2381	57,057	16	24	67%	0.2804
35 - 39	93,865	55	57	96%	0.5860	66,387	45	41	111%	0.6778
40 - 44	83,666	78	81	96%	0.9323	61,153	64	59	108%	1.0466
45 - 49	61,597	72	89	81%	1.1689	47,056	58	68	85%	1.2326
50 - 54	32,728	75	77	98%	2.2917	25,561	64	60	107%	2.5039
55 - 59	8,982	25	38	66%	2.7833	6,517	20	28	73%	3.0689
60 - 64	3,129	14	23	62%	4.4750	2,381	10	17	57%	4.1999
65 - 69	516	7	7	100%	13.5790	515	7	7	100%	13.6054
70 - 99	58	2	2	133%	34.4828	58	2	2	133%	34.4828
Total	538,510	421	482	87%	0.7818	386,290	340	357	95%	0.8802

Table 26: Data – Duration 2+, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	274,384	61	71	86%	0.2223	234,112	52	60	87%	0.2221
20 - 24	366,873	167	186	90%	0.4552	281,078	122	143	86%	0.4340
25 - 29	604,036	261	264	99%	0.4321	452,947	212	198	107%	0.4680
30 - 34	799,673	274	333	82%	0.3426	607,517	228	253	90%	0.3753
35 - 39	926,576	543	565	96%	0.5860	717,054	474	438	108%	0.6610
40 - 44	870,070	756	846	89%	0.8689	691,712	666	673	99%	0.9628
45 - 49	669,155	846	971	87%	1.2643	549,726	749	799	94%	1.3625
50 - 54	391,727	908	922	99%	2.3179	330,669	831	779	107%	2.5131
55 - 59	131,795	499	549	91%	3.7862	111,445	457	464	98%	4.1007
60 - 64	55,477	353	401	88%	6.3630	48,837	330	355	93%	6.7572
65 - 69	16,735	230	223	103%	13.7441	16,153	228	216	105%	14.1155
70 - 99	6,618	204	189	108%	30.8250	6,611	204	189	108%	30.8577
Total	5,113,118	5,102	5,521	92%	0.9978	4,047,858	4,553	4,567	100%	1.1248

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Table 27: Data – Duration 5+, Males

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	196,492	39	50	78%	0.1985	180,992	34	46	74%	0.1879
20 - 24	179,270	84	91	93%	0.4686	146,563	65	74	88%	0.4435
25 - 29	346,878	160	151	106%	0.4613	268,515	137	117	117%	0.5102
30 - 34	544,999	192	227	84%	0.3523	425,853	163	178	92%	0.3828
35 - 39	650,295	376	397	95%	0.5782	514,745	337	315	107%	0.6547
40 - 44	632,680	532	616	86%	0.8409	513,612	472	501	94%	0.9190
45 - 49	501,434	632	729	87%	1.2604	420,479	564	612	92%	1.3413
50 - 54	307,512	723	726	100%	2.3511	264,529	676	625	108%	2.5555
55 - 59	108,461	433	450	96%	3.9922	94,628	402	393	102%	4.2482
60 - 64	47,055	315	341	92%	6.6943	42,226	300	307	98%	7.1046
65 - 69	15,262	219	204	107%	14.3498	14,681	217	197	110%	14.7810
70 - 99	6,476	202	185	109%	31.1921	6,472	202	185	109%	31.2114
Total	3,536,811	3,907	4,169	94%	1.1047	2,893,294	3,569	3,550	101%	1.2335

10.2   Female Insured Lives

Table 28: Data Split by Exposure Year - Females

Age	1998			1999			2000			2001			2002			Total		
Group	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate
15 - 19	31,741	7	0.2205	35,503	5	0.1408	38,601	4	0.1036	41,287	5	0.1211	43,319	4	0.0923	190,450	25	0.1313
20 - 24	51,745	7	0.1353	52,211	5	0.0958	52,273	15	0.2870	48,910	3	0.0613	47,573	15	0.3153	252,711	45	0.1781
25 - 29	96,828	22	0.2272	103,360	19	0.1838	106,587	15	0.1407	88,512	13	0.1469	85,743	30	0.3499	481,030	99	0.2058
30 - 34	111,988	40	0.3572	121,618	37	0.3042	128,360	41	0.3194	126,714	52	0.4104	130,543	33	0.2528	619,222	203	0.3278
35 - 39	111,145	62	0.5578	123,774	53	0.4282	134,514	73	0.5427	142,601	43	0.3015	150,452	63	0.4187	662,484	294	0.4438
40 - 44	95,243	45	0.4725	109,066	86	0.7885	120,905	73	0.6038	130,614	79	0.6048	140,259	75	0.5347	596,087	358	0.6006
45 - 49	65,960	77	1.1674	76,323	99	1.2971	86,548	87	1.0052	97,986	107	1.0920	111,342	109	0.9790	438,158	479	1.0932
50 - 54	32,345	52	1.6077	41,523	54	1.3005	51,518	98	1.9023	62,540	92	1.4711	73,028	120	1.6432	260,953	416	1.5942
55 - 59	14,992	40	2.6682	16,931	51	3.0122	18,587	32	1.7217	21,594	80	3.7048	27,381	72	2.6296	99,483	275	2.7643
60 - 64	5,849	39	6.6678	7,372	24	3.2556	9,327	26	2.7878	11,683	47	4.0229	13,675	46	3.3639	47,905	182	3.7992
65 - 69	1,842	14	7.6004	2,205	20	9.0724	2,770	12	4.3321	3,562	28	7.8619	4,298	19	4.4212	14,676	93	6.3371
70 - 99	732	10	13.6705	845	14	16.5779	1,002	19	18.9621	1,193	23	19.2872	1,402	29	20.6847	5,173	95	18.3664
All	**620,409**	**415**	**0.6689**	**690,728**	**467**	**0.6761**	**750,989**	**495**	**0.6591**	**777,194**	**572**	**0.7360**	**829,011**	**615**	**0.7418**	**3,668,330**	**2,564**	**0.6990**

Table 29: Data for Female Insured Lives

Age	Medical Lives			Non-Medical Lives			Total		
Group	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate	Exposure	Deaths	Crude Rate
15 - 19	13,480	2	0.1484	215,051	27	0.1256	228,531	29	0.1269
20 - 24	19,674	2	0.1017	332,350	53	0.1595	352,023	55	0.1562
25 - 29	42,139	7	0.1661	659,861	126	0.1909	701,999	133	0.1895
30 - 34	61,215	19	0.3104	809,441	213	0.2631	870,656	232	0.2665
35 - 39	74,876	22	0.2938	845,255	326	0.3857	920,130	348	0.3782
40 - 44	76,852	32	0.4164	750,693	377	0.5022	827,544	409	0.4942
45 - 49	64,874	56	0.8632	542,039	491	0.9058	606,913	547	0.9013
50 - 54	49,294	51	1.0346	307,003	411	1.3387	356,297	462	1.2967
55 - 59	36,260	50	1.3789	97,872	247	2.5237	134,132	297	2.2142
60 - 64	23,639	65	2.7498	36,442	133	3.6496	60,081	198	3.2956
65 - 69	8,663	59	6.8106	7,036	34	4.8326	15,699	93	5.9241
70 - 99	3,629	63	17.3602	1,550	32	20.6452	5,179	95	18.3433
All	**474,592**	**428**	**0.9018**	**4,604,590**	**2,470**	**0.5364**	**5,079,182**	**2,898**	**0.5706**

Table 30: Data – Duration 0, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	29,860	5	5	97%	0.1675	20,237	3	4	86%	0.1482
20 - 24	88,644	10	17	59%	0.1128	66,866	8	13	63%	0.1196
25 - 29	100,393	7	22	32%	0.0697	79,088	5	17	29%	0.0632
30 - 34	103,434	16	32	50%	0.1547	83,694	15	26	58%	0.1792
35 - 39	101,140	23	44	52%	0.2274	82,023	21	36	58%	0.2560
40 - 44	90,456	23	59	39%	0.2543	74,544	19	49	39%	0.2549
45 - 49	65,879	21	68	31%	0.3188	54,997	18	57	32%	0.3273
50 - 54	31,788	11	52	21%	0.3460	26,965	10	44	23%	0.3709
55 - 59	11,644	5	30	17%	0.4294	9,804	5	25	20%	0.5100
60 - 64	3,999	3	16	19%	0.7503	3,882	3	15	20%	0.7729
65 - 69	412	3	3	117%	7.2816	412	3	3	117%	7.2816
70 - 99	47	0	1	0%	0.0000	45	0	1	0%	0.0000
Total	627,694	127	349	36%	0.2023	502,555	110	289	38%	0.2189

Table 31: Data – Duration 1, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	25,095	6	4	140%	0.2391	16,079	5	3	181%	0.3110
20 - 24	81,084	9	15	58%	0.1110	57,849	8	11	73%	0.1383
25 - 29	92,088	22	20	109%	0.2389	67,565	16	15	108%	0.2368
30 - 34	96,738	27	30	90%	0.2791	73,256	24	23	105%	0.3276
35 - 39	95,044	28	42	67%	0.2946	71,980	22	31	70%	0.3056
40 - 44	83,704	30	55	55%	0.3584	63,932	25	42	60%	0.3910
45 - 49	61,145	49	63	78%	0.8014	47,391	48	49	98%	1.0129
50 - 54	31,204	22	51	43%	0.7050	24,695	20	40	50%	0.8099
55 - 59	11,394	15	30	51%	1.3165	8,931	14	23	60%	1.5677
60 - 64	4,225	7	16	43%	1.6568	3,804	7	15	47%	1.8404
65 - 69	672	5	4	126%	7.4460	672	5	4	126%	7.4460
70 - 99	61	2	1	172%	33.0579	59	2	1	180%	34.1880
Total	582,450	222	331	67%	0.3811	436,207	196	257	76%	0.4493

Table 32: Data – Duration 2, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	23,597	2	4	50%	0.0848	14,909	1	3	40%	0.0671
20 - 24	76,076	5	14	35%	0.0657	51,929	5	10	51%	0.0963
25 - 29	93,369	17	20	83%	0.1821	64,166	15	14	107%	0.2338
30 - 34	90,221	30	28	107%	0.3325	62,837	26	20	133%	0.4138
35 - 39	89,504	35	39	89%	0.3910	62,196	23	27	85%	0.3698
40 - 44	78,522	35	51	68%	0.4457	54,721	32	36	90%	0.5848
45 - 49	56,297	35	58	60%	0.6217	39,423	29	41	71%	0.7356
50 - 54	29,721	26	48	54%	0.8748	21,432	22	35	63%	1.0265
55 - 59	11,321	20	30	67%	1.7667	8,160	20	21	93%	2.4511
60 - 64	4,337	10	17	60%	2.3057	3,581	7	14	50%	1.9548
65 - 69	757	1	5	22%	1.3219	757	1	5	22%	1.3219
70 - 99	56	0	1	0%	0.0000	54	0	1	0%	0.0000
Total	553,776	216	316	68%	0.3900	384,163	181	226	80%	0.4712

Table 33: Data – Duration 3, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	23,687	4	4	100%	0.1689	15,595	4	3	153%	0.2565
20 - 24	68,124	9	13	69%	0.1321	44,650	8	8	94%	0.1792
25 - 29	101,419	13	22	59%	0.1282	67,453	12	15	82%	0.1779
30 - 34	91,346	14	28	49%	0.1533	60,245	10	19	53%	0.1660
35 - 39	92,160	26	40	64%	0.2821	61,042	20	27	75%	0.3276
40 - 44	81,085	30	53	57%	0.3700	53,671	25	35	71%	0.4658
45 - 49	58,293	41	60	68%	0.7033	38,748	36	40	90%	0.9291
50 - 54	31,524	40	51	78%	1.2689	21,190	36	35	104%	1.6990
55 - 59	11,647	20	31	65%	1.7172	7,822	17	21	82%	2.1735
60 - 64	4,348	17	17	101%	3.9098	3,260	16	13	125%	4.9087
65 - 69	758	6	5	126%	7.9208	758	6	5	126%	7.9208
70 - 99	52	0	1	0%	0.0000	51	0	1	0%	0.0000
Total	564,440	220	326	68%	0.3898	374,481	190	220	86%	0.5074

Table 34: Data – Duration 4, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	24,305	9	4	221%	0.3703	17,270	7	3	243%	0.4053
20 - 24	57,152	6	11	55%	0.1050	37,125	5	7	71%	0.1347
25 - 29	106,947	22	23	94%	0.2057	69,250	17	15	113%	0.2455
30 - 34	93,380	17	29	58%	0.1821	59,020	15	18	82%	0.2542
35 - 39	96,144	34	42	81%	0.3536	61,552	31	27	115%	0.5036
40 - 44	86,588	39	57	69%	0.4504	55,776	29	37	79%	0.5199
45 - 49	63,472	57	66	87%	0.8980	41,236	49	43	115%	1.1883
50 - 54	35,664	30	58	51%	0.8412	23,535	24	39	62%	1.0198
55 - 59	13,234	25	35	71%	1.8891	8,775	22	23	94%	2.5071
60 - 64	5,204	16	20	78%	3.0749	3,860	15	15	99%	3.8860
65 - 69	867	4	6	71%	4.6163	864	4	6	71%	4.6296
70 - 99	113	1	2	53%	8.8496	113	1	2	53%	8.8496
Total	583,065	260	354	74%	0.4459	378,373	219	235	93%	0.5788

Table 35: Data – Duration 2+, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	228,531	29	38	76%	0.1269	190,450	25	32	79%	0.1313
20 - 24	352,023	55	67	82%	0.1562	252,711	45	48	94%	0.1781
25 - 29	701,999	133	155	86%	0.1895	481,030	99	106	93%	0.2058
30 - 34	870,656	232	272	85%	0.2665	619,222	203	194	105%	0.3278
35 - 39	920,130	348	403	86%	0.3782	662,484	294	290	101%	0.4438
40 - 44	827,544	409	541	76%	0.4942	596,087	358	390	92%	0.6006
45 - 49	606,913	547	628	87%	0.9013	438,158	479	454	106%	1.0932
50 - 54	356,297	462	586	79%	1.2967	260,953	416	430	97%	1.5942
55 - 59	134,132	297	351	85%	2.2142	99,483	275	261	105%	2.7643
60 - 64	60,081	198	236	84%	3.2956	47,905	182	189	96%	3.7992
65 - 69	15,699	93	100	93%	5.9241	14,676	93	94	98%	6.3371
70 - 99	5,179	95	92	104%	18.3433	5,173	95	91	104%	18.3664
Total	5,079,182	2,898	3,471	83%	0.5706	3,668,330	2,564	2,579	99%	0.6990

Table 36: Data – Duration 5+, Females

Age	All Policies					Excluding 100% CI Acceleration Policies				
	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate	Exposure	Actual Deaths	Expected Deaths	Actual / Expected	Crude Rate
15 - 19	156,943	14	26	53%	0.0892	142,677	13	24	55%	0.0911
20 - 24	150,672	35	29	122%	0.2323	119,008	27	23	120%	0.2269
25 - 29	400,265	81	89	91%	0.2024	280,162	55	62	88%	0.1963
30 - 34	595,710	171	186	92%	0.2871	437,121	152	137	111%	0.3477
35 - 39	642,324	253	282	90%	0.3939	477,695	220	209	105%	0.4605
40 - 44	581,350	305	380	80%	0.5246	431,920	272	283	96%	0.6297
45 - 49	428,851	414	444	93%	0.9654	318,752	365	330	111%	1.1451
50 - 54	259,389	366	428	85%	1.4110	194,797	334	322	104%	1.7146
55 - 59	97,931	232	256	91%	2.3690	74,727	216	195	111%	2.8905
60 - 64	46,192	155	182	85%	3.3556	37,205	144	147	98%	3.8705
65 - 69	13,318	82	85	96%	6.1571	12,298	82	80	103%	6.6680
70 - 99	4,958	94	88	107%	18.9593	4,955	94	88	107%	18.9727
Total	3,377,901	2,202	2,476	89%	0.6519	2,531,314	1,974	1,899	104%	0.7798

11 APPENDIX C: INITIAL GRADUATION WITH FREE CUBIC SPLINE METHOD

11.1 Introduction to FCS Method

The FCS method gives a set of graduated mortality rates based on the following formula:

$$q_x = a_o + a_1 x + a_2 x^2 + a_3 x^3 + \sum_{i=1}^{n} b_i g_i(x)$$

where

$$g_i(x) = \begin{cases} (x - x_i)^3 \; for & x \geq x_i \\ 0 \quad\;\; for & x < x_i \end{cases}$$

and x_i (i= 1, 2, 3....n) are the knots of the cubic spline. The numbers (a_0, a_1, a_2, a_3 and b_1....b_n) are the unknown coefficients in the cubic spline function.

The graduation minimizes the quadratic Q by taking partial derivatives of Q with respect to (a_0, a_1, a_2, a_3 and b_1....b_n) and setting these partial derivatives to zero. Function Q is given as follows:

$$Q = \sum_{j=0}^{n-1} w_{x+j} (q_{x+j} - q_{x+j}^o)^2$$

where w_x is the set of weights for the squared deviations of crude q_x from the fitted q_x.

We will then arrive at n+4 simultaneous equations which can be solved to obtain the required coefficients.

Once the coefficients are known, q_x can be obtained readily.

11.2   Parameters

(a)   For male lives: the knots used are 22, 31, 36, 40, 55 and 60.

Coefficients =

a0	1.583E-03
a1	-3.189E-04
a2	2.106E-05
a3	-4.059E-07
b1	7.677E-07
b2	-1.852E-07
b3	-8.949E-07
b4	1.274E-06
b5	-9.101E-08
b6	5.058E-06

(b)   For female lives, the knots used are 29, 30, 63, 65, and 73.

Coefficients =

a0	-3.995E-04
a1	6.969E-05
a2	-3.214E-06
a3	5.444E-08
b1	-7.121E-07
b2	7.665E-07
b3	9.447E-06
b4	4.939E-07
b5	2.999E-04

11.3 Graduated Rates Using FCS Method

Table 37: Rates per Mille Based on Free Cubic Spline Method

Age Nearest Birthday	Males	Females	Age Nearest Birthday	Males	Females
15	0.1672	0.1064	46	1.3273	0.9456
16	0.2080	0.1157	47	1.4482	1.0413
17	0.2519	0.1239	48	1.5884	1.1472
18	0.2966	0.1311	49	1.7514	1.2640
19	0.3396	0.1378	50	1.9404	1.3923
20	0.3786	0.1443	51	2.1588	1.5327
21	0.4113	0.1508	52	2.4098	1.6859
22	0.4352	0.1578	53	2.6968	1.8525
23	0.4487	0.1656	54	3.0230	2.0333
24	0.4531	0.1744	55	3.3917	2.2288
25	0.4505	0.1847	56	3.8063	2.4398
26	0.4428	0.1967	57	4.2701	2.6668
27	0.4321	0.2107	58	4.7864	2.9105
28	0.4205	0.2272	59	5.3584	3.1716
29	0.4100	0.2463	60	5.9895	3.4507
30	0.4026	0.2678	61	6.6878	3.7484
31	0.4003	0.2892	62	7.4809	4.0655
32	0.4052	0.3103	63	8.4011	4.4026
33	0.4193	0.3318	64	9.4809	4.7700
34	0.4447	0.3544	65	10.7525	5.2167
35	0.4833	0.3787	66	12.2484	5.8015
36	0.5363	0.4054	67	14.0009	6.5832
37	0.6008	0.4350	68	16.0425	7.6204
38	0.6729	0.4684	69	18.4054	8.9719
39	0.7490	0.5061	70	21.1222	10.6964
40	0.8252	0.5487	71	24.2250	12.8526
41	0.8989	0.5970	72	27.7465	15.4994
42	0.9722	0.6515	73	31.7188	18.6953
43	1.0483	0.7130	74	36.1744	22.8120
44	1.1307	0.7821	75	41.1457	29.4718
45	1.2226	0.8594			

12   APPENDIX D: CHARTS ON GRADUATED RATES 97-02 AGAINST S8388 AND S8893

Males
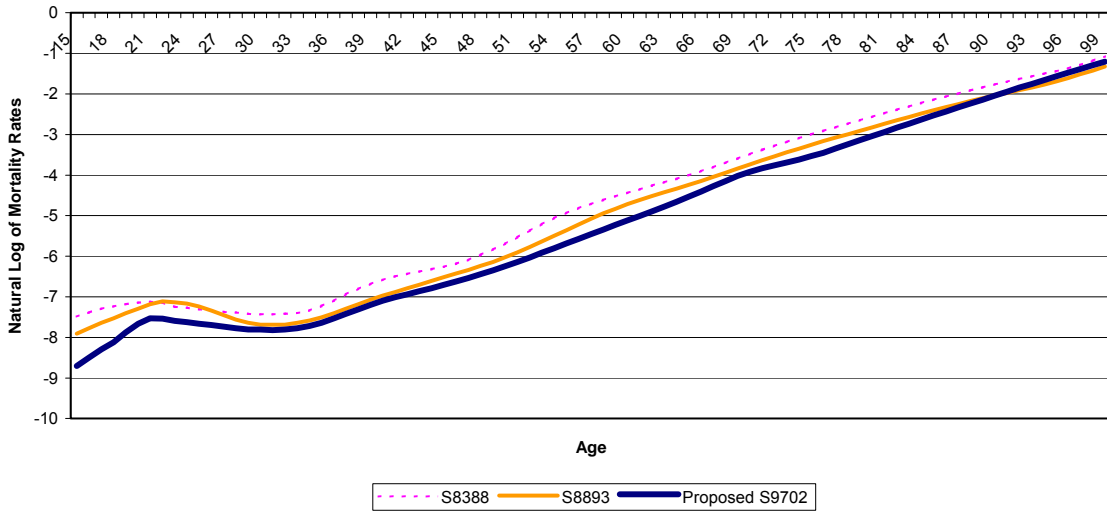
Females
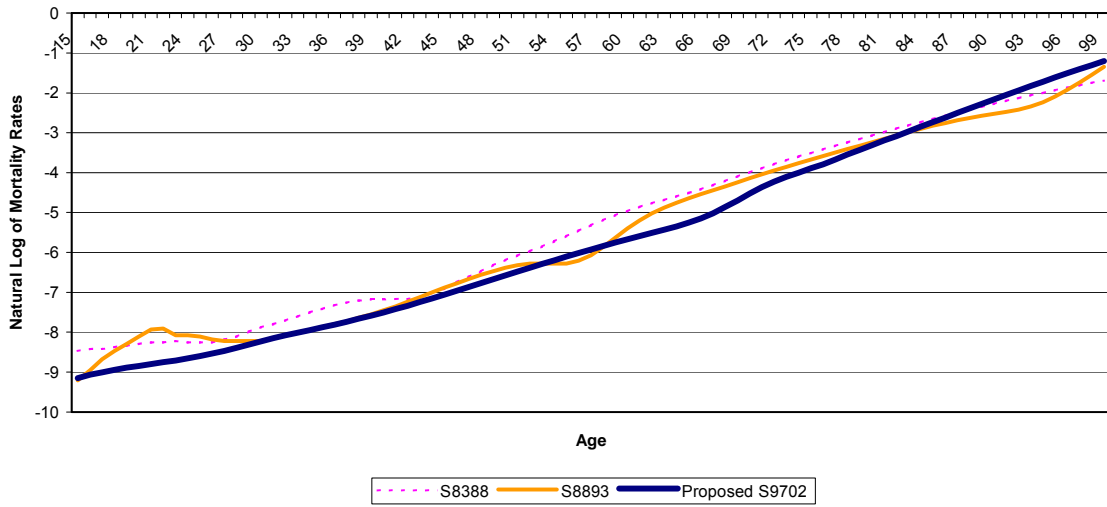
13 APPENDIX E: CHARTS ON GRADUATED RATES 97-02 AGAINST CRUDE RATES

13.1 Charts on Male Insured Mortality

Males
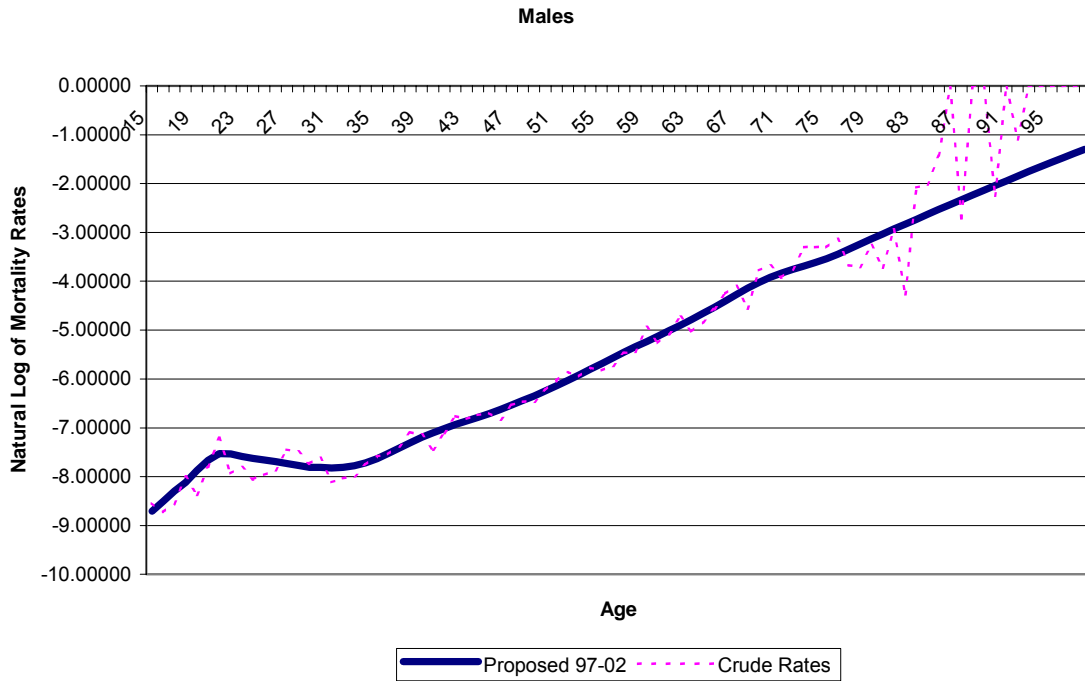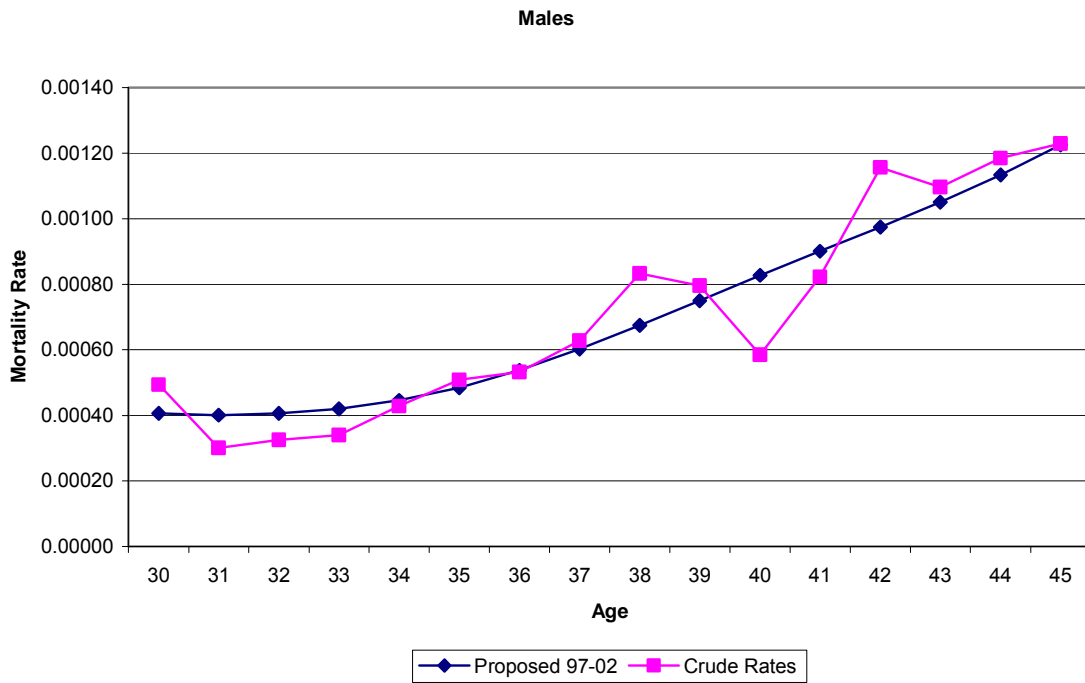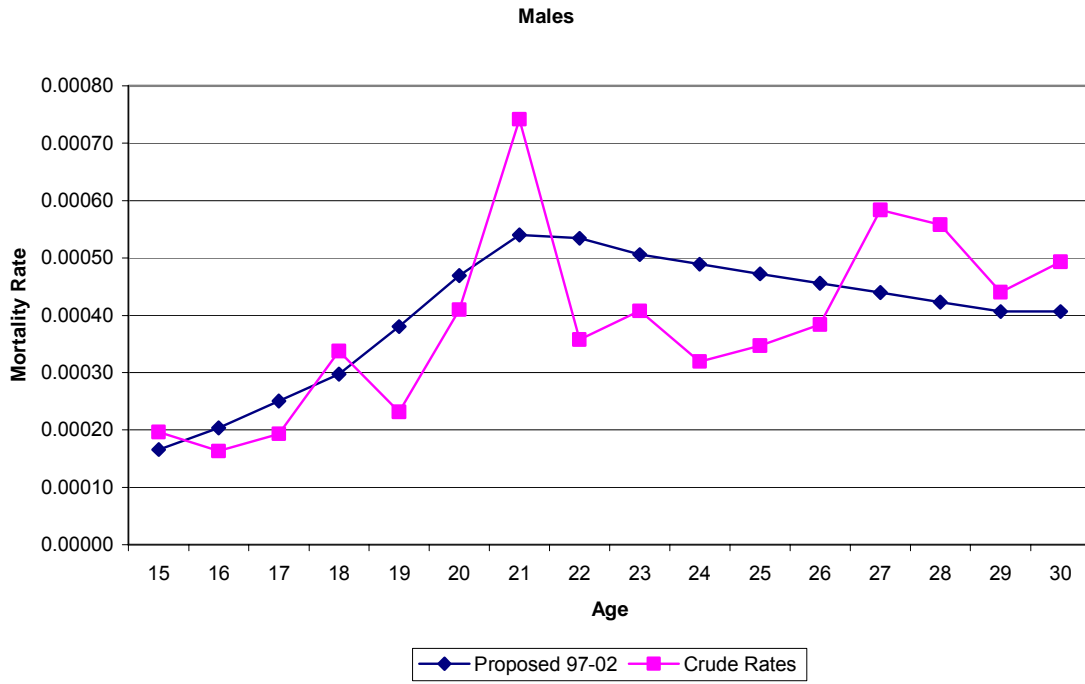
Males
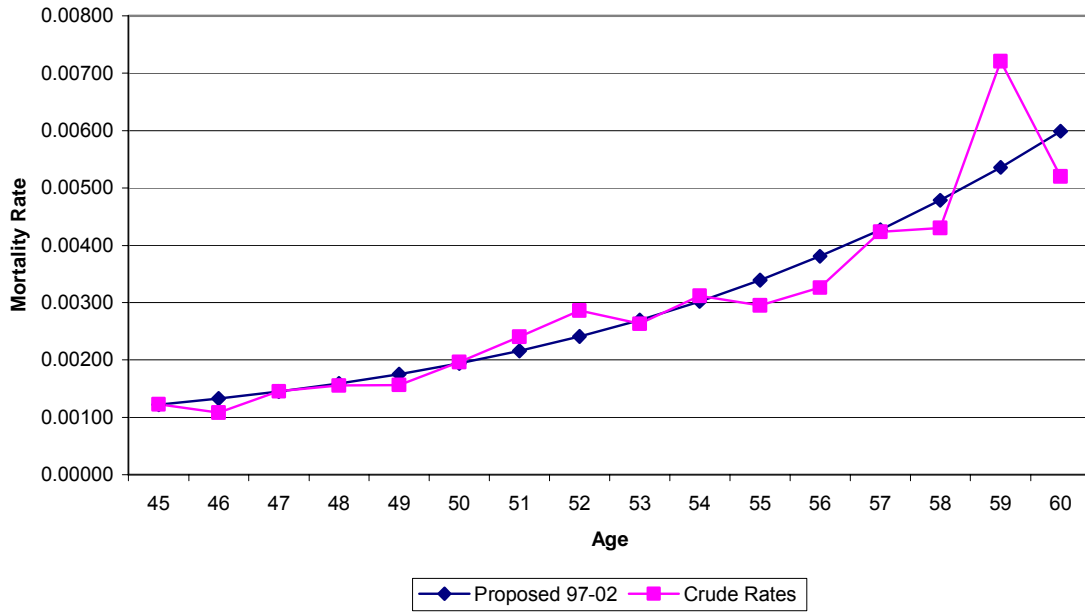
Males
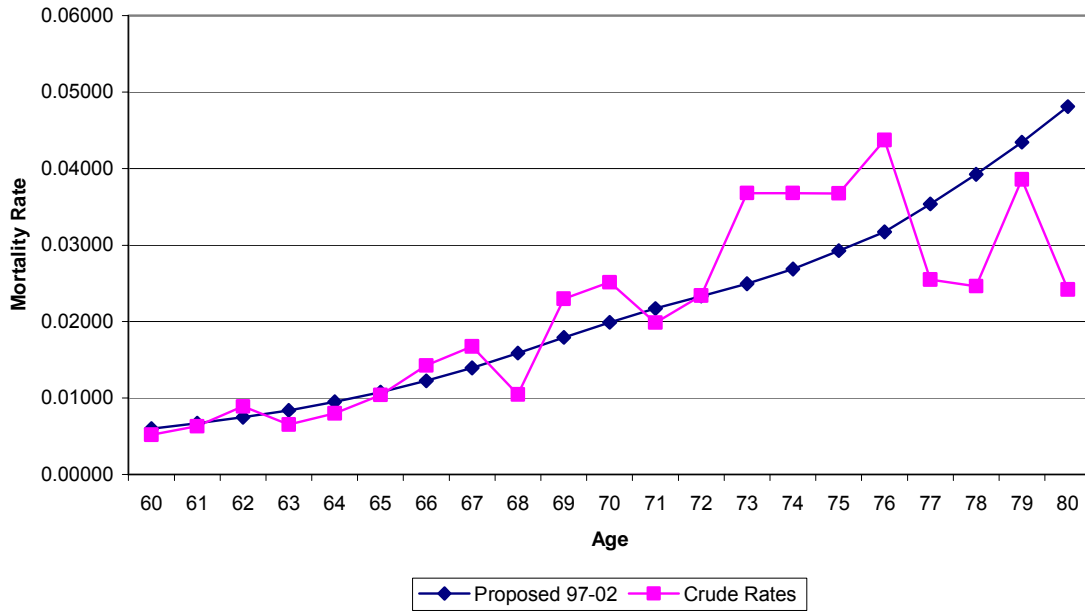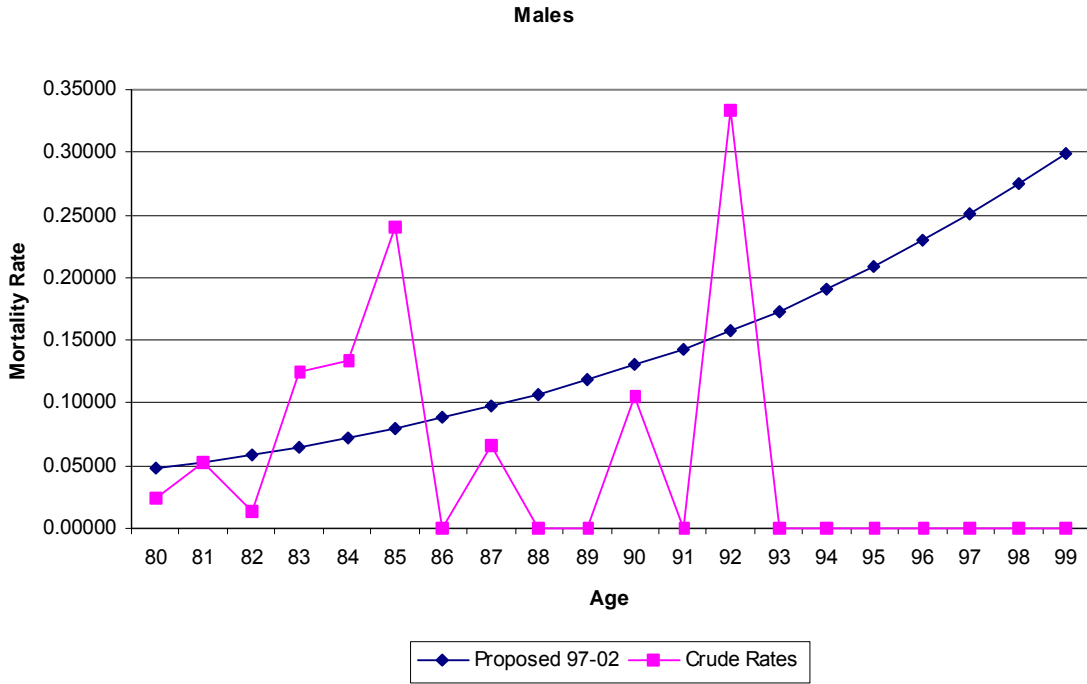
Males

Males

Males

13.2   Charts on Female Insured Mortality
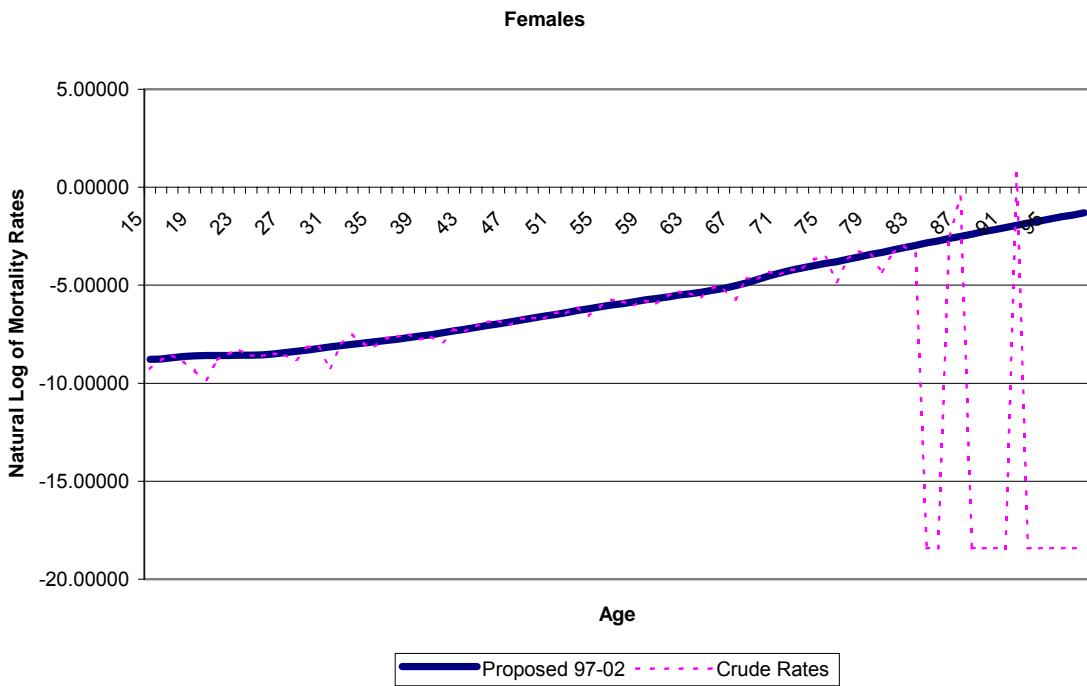
Females
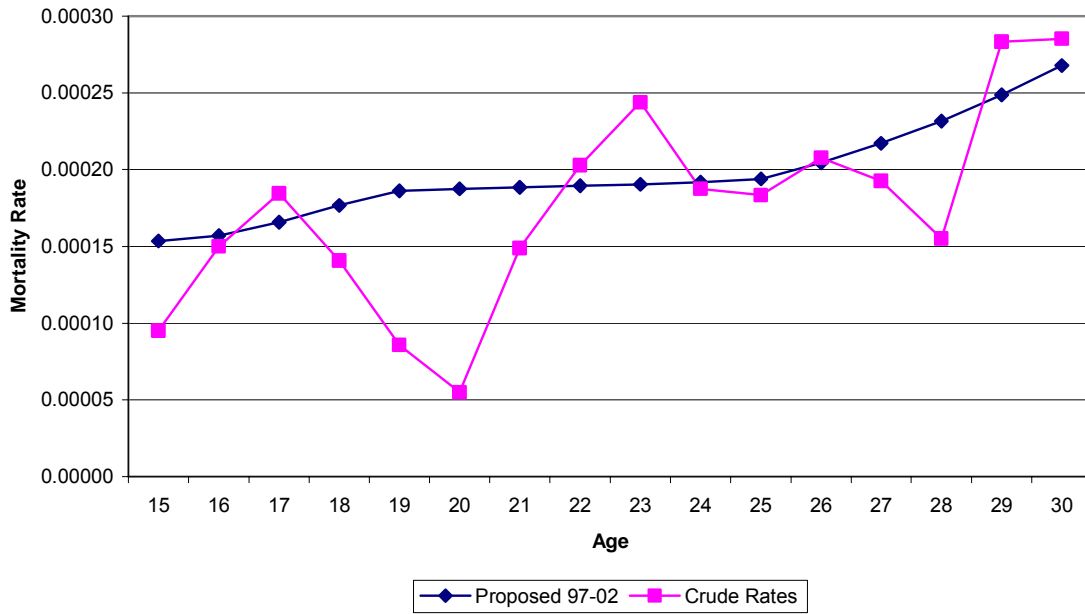
Females
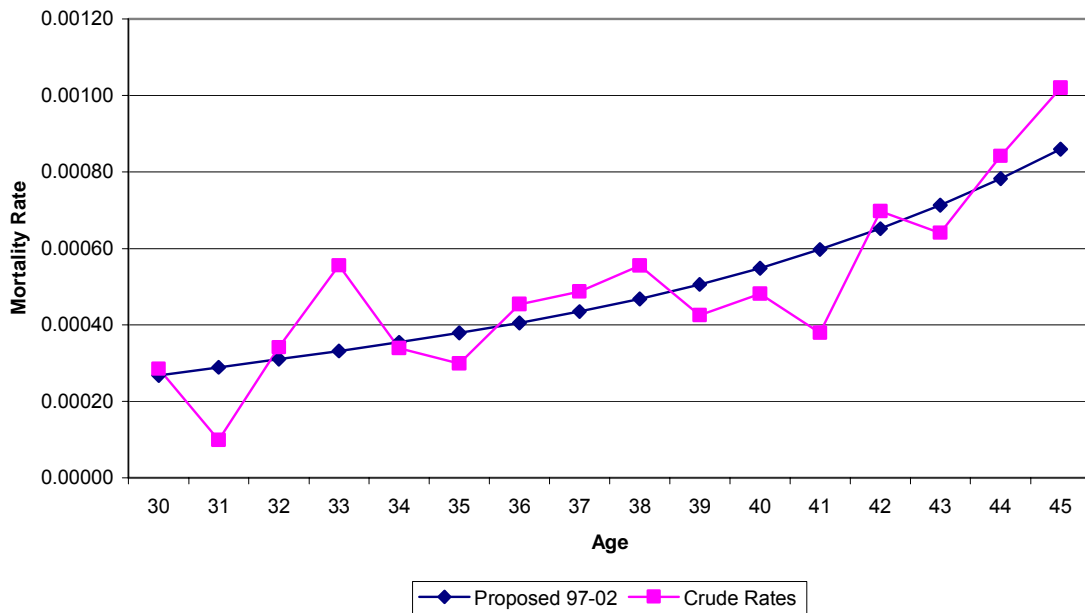
Females
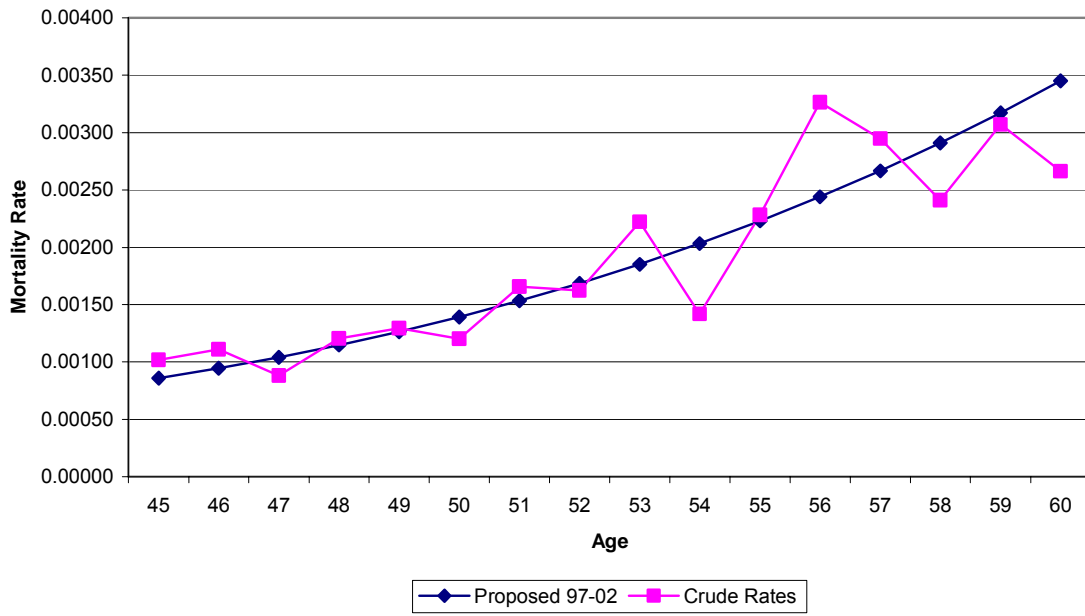
Females

Females

Females
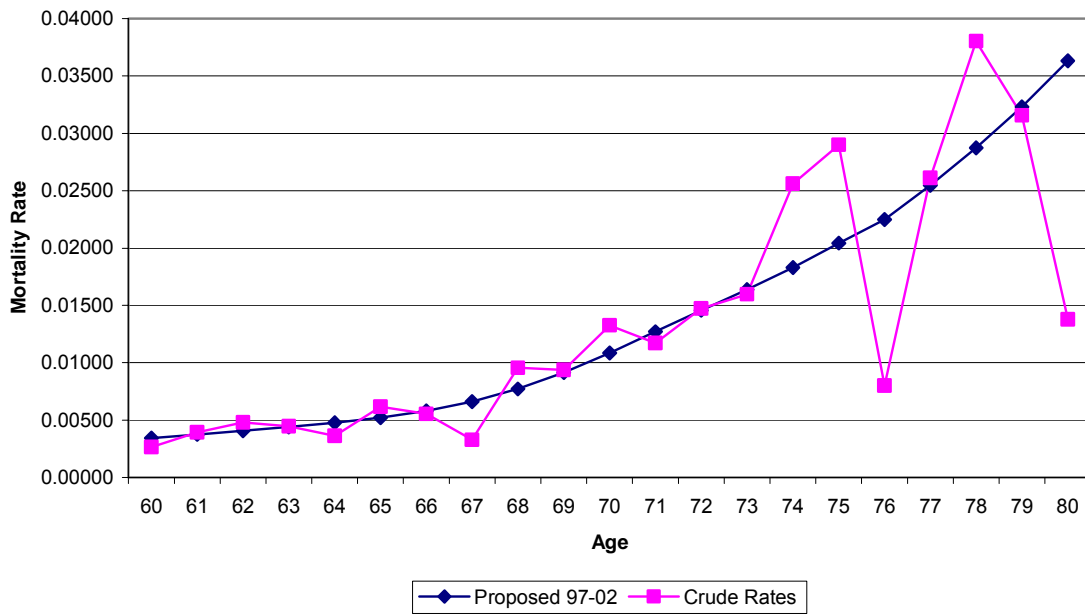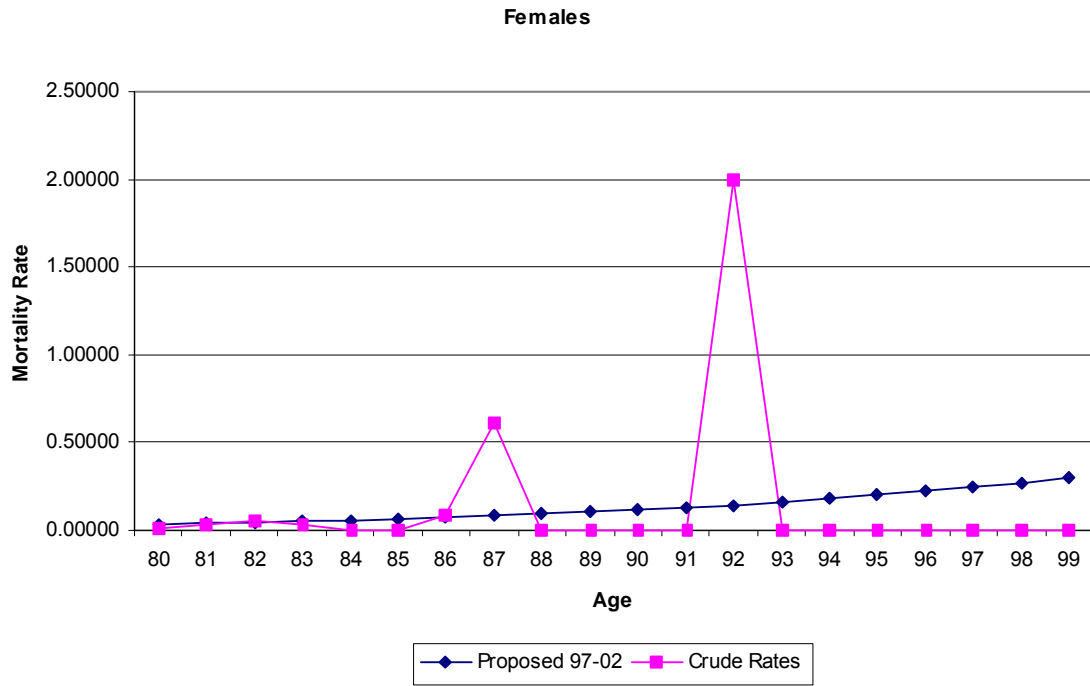
14 APPENDIX F: SMOOTHNESS TESTS

14.1 Barnett's Rule of Thumb for Smoothness

A table has n^{th} order smoothness if: $[\Delta^n q_x] \times 7^n < q_x$

This test does not work so well when the mortality rates are low and the mortality rates are rounded to 5-decimal places.

A further criterion is that the second differences (i.e. $\Delta^2 q_x$) should only change sign (i.e. from positive to negative or vice versa) before and after a patch of "intrinsic roughness". An example of "intrinsic roughness" is the Accident Hump where the table is not expected to be smooth.

15 APPENDIX G: CLEANED RAW DATA

15.1 MAS 303 Returns

(a) All Companies

Table 38: Males, Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,737	1,649	1,248	1,635	1,430	3,896	0	0	1	0	0	2
15 - 19	475	442	310	425	455	1,903	0	0	0	0	0	0
20 - 24	1,215	1,066	665	717	616	1,607	1	0	0	0	0	1
25 - 29	1,715	1,680	1,077	1,313	1,492	3,552	0	2	0	1	1	4
30 - 34	2,554	2,033	1,340	1,658	1,896	7,844	0	0	0	1	1	11
35 - 39	2,894	2,474	1,676	2,221	2,273	12,550	2	2	2	2	0	7
40 - 44	2,459	2,389	1,733	2,661	2,547	17,213	1	3	2	3	2	14
45 - 49	1,689	1,583	1,378	2,533	2,068	18,544	0	3	3	0	2	18
50 - 54	875	1,007	872	1,641	1,443	12,019	0	3	3	3	1	22
55 - 59	601	681	532	893	1,070	7,560	0	4	1	5	3	26
60 - 64	349	316	245	306	464	3,689	4	0	1	4	4	23
65 - 69	126	136	91	104	165	1,749	0	1	1	0	0	16
70 - 99	319	290	121	94	116	1,038	0	1	0	0	0	19
Total	17,008	15,746	11,288	16,201	16,035	93,164	8	19	14	19	14	163

Table 39: Males, Non-Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	34,033	37,112	35,260	28,589	23,381	66,091	1	4	3	1	5	5
15 - 19	8,786	7,711	7,177	5,678	5,021	21,596	2	3	2	1	1	2
20 - 24	18,942	20,573	18,987	13,505	11,506	22,692	12	13	7	11	4	17
25 - 29	19,682	20,732	20,234	17,238	18,471	54,521	6	7	4	8	8	15
30 - 34	27,963	20,055	17,824	15,760	17,052	85,364	4	6	4	9	3	52
35 - 39	25,118	19,079	17,100	15,419	15,616	86,047	5	13	10	11	9	48
40 - 44	17,885	14,850	14,157	13,459	12,626	74,353	13	18	9	21	13	84
45 - 49	11,408	9,613	9,844	10,346	9,465	51,139	16	9	11	15	6	70
50 - 54	3,509	3,495	4,136	4,417	4,247	25,494	2	5	6	16	9	59
55 - 59	1,575	1,648	1,965	1,614	1,696	12,603	5	4	6	8	4	42
60 - 64	1,050	809	847	719	1,001	6,333	1	2	1	3	10	14
65 - 69	589	441	430	347	546	3,557	0	0	0	0	1	10
70 - 99	2,320	2,557	2,114	1,722	1,957	9,051	0	0	1	1	3	9
Total	172,860	158,675	150,075	128,813	122,585	518,841	67	84	64	105	76	427

Table 40: Females, Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,383	1,148	1,006	1,197	1,156	2,945	0	0	0	0	0	1
15 - 19	464	387	251	372	339	1,251	0	0	0	0	0	1
20 - 24	1,452	1,266	847	810	683	1,198	0	0	0	2	0	0
25 - 29	1,801	1,488	1,100	1,381	1,436	3,833	0	0	2	0	0	0
30 - 34	1,873	1,680	1,146	1,531	1,692	7,264	0	2	0	0	0	4
35 - 39	1,939	1,764	1,289	1,780	1,881	8,866	0	0	0	1	1	1
40 - 44	1,691	1,536	1,262	1,922	1,865	8,845	0	1	0	1	1	2
45 - 49	1,318	1,291	1,052	1,750	1,601	7,683	1	1	0	0	2	7
50 - 54	934	1,179	939	1,438	1,219	4,858	0	0	2	1	4	5
55 - 59	636	885	667	1,115	1,492	4,606	1	1	0	1	3	11
60 - 64	329	384	297	384	597	2,601	0	0	0	1	2	8
65 - 69	157	178	115	128	169	1,132	0	0	0	0	1	5
70 - 99	255	269	87	66	101	682	0	1	0	0	0	13
Total	14,232	13,455	10,058	13,874	14,231	55,764	2	6	4	7	14	58

Table 41: Females, Non-Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	30,036	31,971	29,995	24,507	19,755	53,097	3	7	1	3	0	3
15 - 19	7,945	7,220	6,540	5,182	4,478	16,649	1	1	0	1	1	2
20 - 24	20,700	23,820	21,408	15,875	13,021	19,471	2	3	2	2	3	3
25 - 29	20,059	21,807	22,299	20,585	22,211	60,572	1	3	5	5	6	16
30 - 34	23,141	21,159	19,366	18,080	19,185	82,734	2	4	4	12	1	23
35 - 39	20,264	20,190	18,765	17,238	19,141	77,092	3	6	2	9	5	25
40 - 44	15,799	16,406	16,462	15,519	15,599	62,109	2	4	5	7	8	39
45 - 49	10,003	10,988	11,508	11,193	11,524	41,777	6	6	5	7	11	35
50 - 54	3,535	4,231	5,111	4,984	5,482	20,771	0	3	10	7	5	26
55 - 59	2,040	2,457	3,034	2,311	2,462	11,243	2	3	5	2	3	13
60 - 64	1,203	1,024	1,099	1,009	1,538	6,225	0	0	0	2	3	7
65 - 69	800	539	580	458	810	4,295	0	0	1	0	2	6
70 - 99	2,141	2,301	1,930	1,519	1,782	7,173	0	0	0	1	2	6
Total	157,666	164,113	158,097	138,460	136,988	463,208	22	40	40	58	50	204

Table 42: Males, Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,634	1,749	1,498	1,152	1,463	4,910	0	0	0	1	0	4
15 - 19	417	357	404	301	434	2,401	0	0	0	0	0	2
20 - 24	1,274	994	832	535	592	2,021	0	0	0	0	0	4
25 - 29	2,125	1,676	1,531	1,014	1,181	4,225	0	0	1	0	0	6
30 - 34	2,160	2,488	1,817	1,199	1,513	8,864	0	2	1	1	0	4
35 - 39	2,262	3,048	2,303	1,584	1,965	13,723	1	1	2	1	1	12
40 - 44	1,711	2,598	2,332	1,684	2,509	19,088	0	1	4	2	0	13
45 - 49	1,060	1,793	1,617	1,379	2,476	20,277	3	3	2	2	1	24
50 - 54	686	1,066	1,042	865	1,684	14,529	1	1	0	1	4	29
55 - 59	398	606	638	458	881	8,512	0	0	2	1	3	20
60 - 64	206	349	298	221	254	4,242	0	0	0	0	0	24
65 - 69	129	149	137	93	92	1,996	0	2	0	0	1	24
70 - 99	218	361	276	111	87	1,252	0	0	0	0	0	39
Total	14,280	17,234	14,725	10,596	15,131	106,040	5	10	12	9	10	205

Table 43: Males, Non-Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	28,188	31,822	34,352	33,166	26,985	82,994	0	2	4	2	0	10
15 - 19	8,275	5,982	6,366	6,718	5,548	27,772	3	2	4	0	1	5
20 - 24	18,630	16,772	16,422	15,747	10,793	27,291	8	7	5	3	5	14
25 - 29	18,332	17,963	19,835	20,075	17,053	64,406	5	8	6	6	4	22
30 - 34	17,279	26,413	18,478	17,253	15,177	96,666	11	10	7	10	5	43
35 - 39	14,349	25,601	18,325	16,702	15,125	101,259	8	12	12	8	11	57
40 - 44	10,161	19,236	15,171	14,563	13,328	89,985	12	19	25	16	26	82
45 - 49	5,990	12,582	10,279	10,278	10,729	64,412	10	16	11	13	14	93
50 - 54	2,128	4,893	4,508	5,114	5,335	34,267	4	6	13	9	11	72
55 - 59	992	1,682	1,663	2,052	1,796	14,878	2	1	3	3	2	41
60 - 64	552	1,111	850	914	809	7,397	0	2	1	1	1	32
65 - 69	386	590	410	404	342	3,974	0	0	0	0	0	5
70 - 99	1,687	2,351	2,423	2,058	1,672	10,537	0	0	0	0	1	6
Total	126,949	166,998	149,082	145,044	124,692	625,838	63	85	91	71	81	482

Table 44: Females, Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,309	1,375	1,026	937	1,090	3,765	0	0	0	0	0	0
15 - 19	445	350	309	231	356	1,609	0	2	0	1	0	0
20 - 24	1,619	1,325	1,000	669	611	1,549	0	1	0	0	0	0
25 - 29	1,872	1,790	1,417	1,104	1,358	4,451	0	0	0	0	0	1
30 - 34	1,671	2,009	1,550	1,112	1,395	8,333	0	0	1	0	0	4
35 - 39	1,450	2,058	1,700	1,261	1,697	10,463	0	0	1	0	1	2
40 - 44	1,270	1,889	1,613	1,202	1,900	10,670	0	1	1	3	0	3
45 - 49	998	1,370	1,247	1,089	1,634	9,297	0	0	0	1	1	8
50 - 54	908	1,112	1,210	899	1,453	6,299	0	1	1	2	4	9
55 - 59	499	676	891	646	1,156	5,754	0	1	0	2	1	11
60 - 64	277	361	373	280	384	3,335	0	0	0	1	0	13
65 - 69	120	170	174	113	113	1,381	0	2	0	1	2	5
70 - 99	215	300	259	82	60	844	0	0	0	0	0	6
Total	12,653	14,785	12,769	9,625	13,207	67,750	0	8	4	11	9	62

Table 45: Females, Non-Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	25,662	27,986	29,647	28,170	23,195	67,759	2	5	2	1	4	3
15 - 19	7,181	5,682	5,957	5,905	4,922	21,793	4	2	2	0	2	4
20 - 24	19,134	18,283	19,515	17,110	12,003	23,921	0	1	0	3	1	5
25 - 29	17,375	19,437	22,323	23,172	21,052	73,657	0	2	3	2	5	16
30 - 34	15,444	22,949	20,376	18,890	17,546	98,363	4	3	7	0	4	29
35 - 39	13,425	20,704	20,027	18,758	16,999	95,127	3	7	6	8	8	47
40 - 44	10,645	16,822	16,903	16,773	15,736	80,397	0	8	4	10	6	38
45 - 49	6,840	10,968	11,758	12,144	11,744	55,252	1	7	4	8	14	48
50 - 54	2,686	4,662	5,392	6,264	6,185	30,570	2	5	7	10	2	36
55 - 59	1,370	2,197	2,568	3,129	2,511	14,086	0	5	2	3	5	23
60 - 64	657	1,337	1,178	1,279	1,145	7,856	0	2	2	4	5	18
65 - 69	484	814	531	579	471	4,891	0	0	0	1	0	5
70 - 99	1,656	2,152	2,191	1,892	1,488	8,579	0	1	0	0	1	4
Total	122,559	153,993	158,366	154,065	134,997	582,251	16	48	39	50	57	276

Table 46: Males, Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	853	1,509	1,609	1,386	1,057	5,346	0	0	0	0	1	3
15 - 19	253	337	339	414	308	2,729	0	0	1	0	1	2
20 - 24	827	932	720	636	416	2,324	0	0	0	0	0	2
25 - 29	1,523	1,846	1,495	1,433	931	4,263	1	1	0	0	0	11
30 - 34	1,827	2,095	2,118	1,658	1,088	8,236	0	0	0	0	1	8
35 - 39	1,983	2,255	2,921	2,209	1,472	12,160	0	1	3	1	4	13
40 - 44	1,743	1,759	2,589	2,366	1,646	17,021	1	0	2	2	1	23
45 - 49	1,307	1,147	1,875	1,763	1,447	18,394	1	1	2	2	2	26
50 - 54	906	785	1,213	1,128	941	14,701	1	0	3	1	4	28
55 - 59	601	501	519	622	500	8,433	0	0	2	1	1	32
60 - 64	348	259	295	330	252	4,534	0	0	1	2	4	25
65 - 69	170	152	105	132	103	1,971	0	0	1	0	1	28
70 - 99	425	268	212	179	91	1,223	0	0	0	0	1	24
Total	12,766	13,845	16,010	14,256	10,252	101,335	4	3	15	9	21	225

Table 47: Males, Non-Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	28,540	25,873	29,312	32,382	30,951	100,709	5	6	4	1	4	7
15 - 19	7,339	5,433	4,698	5,917	6,284	33,860	4	4	1	1	0	8
20 - 24	15,500	15,100	13,519	13,522	12,835	31,763	10	5	2	7	5	12
25 - 29	16,325	16,049	16,158	19,404	19,802	71,056	6	1	8	10	7	24
30 - 34	15,916	14,977	22,554	17,211	16,607	103,817	6	3	6	4	7	30
35 - 39	15,766	13,510	25,359	18,061	16,282	116,170	5	4	16	12	4	63
40 - 44	12,839	9,884	19,614	15,282	14,738	106,426	6	8	16	8	9	95
45 - 49	8,478	6,350	13,208	10,745	10,730	81,247	6	11	16	10	11	99
50 - 54	3,708	2,613	6,082	5,395	5,818	46,812	5	5	10	15	14	104
55 - 59	2,073	1,080	1,496	1,570	2,075	17,740	2	1	1	0	5	46
60 - 64	1,119	623	851	767	871	8,646	0	2	2	0	4	36
65 - 69	497	354	476	307	330	4,080	0	0	0	0	1	13
70 - 99	2,183	1,854	1,733	1,692	1,690	9,733	0	0	1	0	3	11
Total	130,283	113,700	155,060	142,255	139,013	732,059	55	50	83	68	74	548

Table 48: Females, Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	678	1,208	1,264	966	866	4,085	0	0	0	0	0	0
15 - 19	326	331	257	279	237	1,912	0	0	0	0	0	0
20 - 24	1,090	1,268	1,037	751	479	1,775	0	1	0	0	0	0
25 - 29	1,477	1,841	1,592	1,386	1,055	4,623	0	0	0	0	1	1
30 - 34	1,442	1,683	1,990	1,441	1,088	7,961	1	0	1	0	0	3
35 - 39	1,282	1,478	1,965	1,666	1,182	10,198	0	0	0	0	0	1
40 - 44	1,252	1,355	1,900	1,619	1,221	10,814	0	0	3	1	0	9
45 - 49	1,097	1,010	1,339	1,265	1,022	9,289	1	0	0	0	3	9
50 - 54	1,057	1,046	1,152	1,200	914	6,747	0	0	0	1	0	5
55 - 59	731	586	671	908	688	5,874	0	0	0	3	0	16
60 - 64	356	328	343	410	325	3,968	1	1	1	3	0	7
65 - 69	180	143	155	211	129	1,469	0	1	0	0	1	15
70 - 99	345	243	174	159	80	886	0	0	0	0	0	9
Total	11,313	12,520	13,839	12,261	9,286	69,601	3	3	5	8	5	75

Table 49: Females, Non-Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	25,584	23,528	25,557	27,877	26,286	83,420	2	5	4	2	1	4
15 - 19	6,217	4,874	4,553	5,321	5,684	26,911	0	1	0	1	4	0
20 - 24	17,079	15,862	14,508	15,329	13,027	27,881	2	0	1	2	0	2
25 - 29	17,534	16,407	18,646	22,987	23,417	83,035	2	1	7	3	3	10
30 - 34	17,378	14,373	21,375	19,497	18,509	111,044	0	4	4	4	3	29
35 - 39	17,045	13,124	20,522	19,672	18,397	113,014	1	7	10	2	6	43
40 - 44	15,199	10,819	17,379	17,143	17,153	99,679	6	7	7	7	14	66
45 - 49	10,926	7,391	11,725	12,260	12,674	71,309	2	4	10	9	10	74
50 - 54	5,323	3,427	5,712	6,324	7,241	42,720	0	3	2	2	2	58
55 - 59	3,097	1,535	2,076	2,375	2,949	17,412	0	0	7	6	6	25
60 - 64	1,572	793	1,146	1,089	1,367	9,194	0	1	2	0	3	10
65 - 69	746	442	581	396	391	5,012	0	1	0	0	0	5
70 - 99	1,959	1,745	1,632	1,510	1,515	7,835	0	0	0	0	0	6
Total	139,659	114,320	145,412	151,780	148,610	698,466	15	34	54	38	52	332

Table 50: Males, Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,054	810	1,410	1,513	1,288	5,665	1	0	1	1	0	1
15 - 19	240	188	292	337	407	2,972	0	0	0	0	0	3
20 - 24	674	602	705	596	542	2,666	0	0	0	1	1	5
25 - 29	1,160	1,339	1,643	1,360	1,217	4,325	0	0	0	0	1	10
30 - 34	1,331	1,721	2,020	1,949	1,556	8,300	1	1	0	3	0	6
35 - 39	1,635	1,914	2,125	2,855	2,057	12,629	1	1	0	4	3	11
40 - 44	1,415	1,707	1,814	2,697	2,322	17,287	1	1	1	4	2	17
45 - 49	883	1,307	1,178	2,096	1,889	19,460	1	0	4	3	0	27
50 - 54	726	938	781	1,375	1,233	17,044	3	3	1	9	3	21
55 - 59	384	527	461	588	674	8,777	0	2	1	1	0	22
60 - 64	212	319	259	392	376	5,408	0	1	1	1	0	25
65 - 69	113	169	133	157	165	2,300	0	0	0	2	3	24
70 - 99	341	343	182	352	268	1,580	0	0	0	0	0	21
Total	10,168	11,884	13,003	16,267	13,994	108,413	8	9	9	29	13	193

Table 51: Males, Non-Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	29,919	26,362	23,756	27,956	30,388	119,829	4	3	3	2	4	8
15 - 19	6,677	4,928	4,002	4,403	5,783	40,786	0	1	1	2	1	5
20 - 24	13,498	13,502	12,581	12,270	11,075	38,256	9	12	11	8	6	18
25 - 29	14,300	15,066	15,139	15,482	18,612	79,137	5	3	5	8	5	35
30 - 34	15,683	14,439	13,742	20,543	16,588	111,435	6	5	5	10	2	36
35 - 39	17,388	14,934	12,851	25,065	17,757	128,526	4	10	11	15	12	63
40 - 44	15,303	12,830	9,849	19,932	15,562	120,625	7	3	14	24	14	98
45 - 49	11,221	8,720	6,615	13,807	11,477	95,422	10	7	13	25	11	110
50 - 54	6,002	4,306	3,033	7,239	6,466	60,763	6	3	11	21	11	122
55 - 59	2,630	1,693	939	1,769	1,752	21,172	6	3	4	5	5	71
60 - 64	1,636	1,095	594	1,083	949	10,849	1	2	2	2	2	21
65 - 69	762	595	328	565	358	4,913	0	2	0	1	0	24
70 - 99	2,628	2,482	1,367	2,109	2,236	13,314	0	2	0	0	1	10
Total	137,647	120,952	104,796	152,223	139,003	845,027	58	56	80	123	74	621

Table 52: Females, Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	866	645	1,128	1,194	896	4,396	0	0	0	1	0	0
15 - 19	271	220	242	243	265	2,142	0	0	0	0	0	0
20 - 24	915	900	987	817	577	1,990	0	0	0	0	0	1
25 - 29	1,081	1,391	1,762	1,507	1,308	4,740	0	0	0	0	0	1
30 - 34	1,124	1,359	1,658	1,888	1,386	8,207	0	0	1	1	0	2
35 - 39	1,182	1,272	1,505	2,051	1,620	11,011	0	0	0	1	1	9
40 - 44	1,054	1,213	1,365	1,929	1,611	11,882	0	1	0	0	2	13
45 - 49	882	1,103	993	1,523	1,352	10,559	1	1	1	0	0	14
50 - 54	1,017	1,132	1,048	1,259	1,198	8,427	0	1	0	2	0	15
55 - 59	620	756	576	719	1,001	6,156	0	0	0	2	0	7
60 - 64	318	417	361	451	503	4,858	0	1	0	0	0	11
65 - 69	162	223	152	192	245	1,944	0	0	0	0	0	6
70 - 99	343	323	178	292	250	1,167	0	0	0	0	0	15
Total	9,835	10,954	11,955	14,065	12,212	77,479	1	4	2	7	3	94

Table 53: Females, Non-Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	25,775	23,575	21,419	24,215	26,074	99,768	3	6	3	4	2	17
15 - 19	5,850	4,506	3,894	4,172	5,122	33,017	0	0	0	0	0	4
20 - 24	15,333	14,435	13,072	11,592	11,719	33,157	1	3	3	0	2	12
25 - 29	16,056	16,540	16,080	18,566	22,883	92,432	1	2	2	0	7	11
30 - 34	18,056	16,410	13,556	20,115	18,849	123,521	4	8	9	3	3	33
35 - 39	19,471	16,545	12,670	20,989	19,534	129,418	3	4	10	7	4	58
40 - 44	18,957	15,203	10,870	17,950	17,708	117,933	10	2	5	8	10	60
45 - 49	15,429	11,349	7,608	12,642	13,021	88,265	3	5	4	10	9	72
50 - 54	9,590	6,438	4,026	7,198	7,688	57,889	2	0	4	10	5	83
55 - 59	5,093	3,172	1,388	2,312	2,574	22,015	0	0	1	2	1	26
60 - 64	3,151	1,917	794	1,473	1,401	12,318	0	1	0	2	2	13
65 - 69	1,762	951	425	776	435	6,125	1	0	0	1	0	6
70 - 99	3,462	3,136	1,356	1,954	1,973	11,121	0	2	0	0	0	4
Total	157,985	134,177	107,158	143,954	148,981	826,979	28	33	41	47	45	399

Table 54: Males, Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	2,627	1,101	813	1,375	1,512	6,379	0	0	0	0	0	0
15 - 19	215	205	182	291	384	3,408	0	0	0	1	0	2
20 - 24	561	557	512	576	527	3,108	1	0	0	1	1	1
25 - 29	1,173	1,040	1,219	1,463	1,328	4,813	3	0	0	0	2	3
30 - 34	1,278	1,154	1,583	1,950	1,858	8,913	0	0	1	3	0	3
35 - 39	1,404	1,478	1,900	2,166	2,870	13,655	1	2	1	0	2	14
40 - 44	1,163	1,402	1,717	1,945	2,997	18,747	2	5	0	0	1	12
45 - 49	806	875	1,332	1,297	2,459	21,404	2	1	1	3	0	14
50 - 54	605	704	978	849	1,597	19,559	3	4	0	2	3	42
55 - 59	350	348	452	396	514	10,045	1	0	0	0	0	24
60 - 64	209	179	239	207	251	6,376	2	0	1	1	2	37
65 - 69	29	36	62	65	82	2,577	0	1	0	0	0	29
70 - 99	1	0	2	1	8	1,422	0	0	0	0	0	36
Total	10,421	9,079	10,991	12,581	16,387	120,406	15	13	4	11	11	217

Table 55: Males, Non-Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	25,830	28,147	25,424	23,066	27,927	142,630	3	2	2	0	2	11
15 - 19	5,844	4,475	4,034	3,653	4,463	49,415	2	1	3	1	3	14
20 - 24	16,238	12,588	11,856	10,894	9,802	42,330	4	4	10	5	6	14
25 - 29	28,558	13,480	14,667	14,766	15,628	58,542	5	8	5	4	13	32
30 - 34	34,740	13,801	13,792	13,503	18,291	116,535	7	5	2	4	3	39
35 - 39	38,885	16,005	14,899	13,308	27,047	148,005	9	7	10	5	13	63
40 - 44	37,535	14,986	13,549	10,549	23,528	143,986	12	13	11	8	22	114
45 - 49	28,763	11,429	9,274	7,452	16,724	116,435	12	11	11	8	18	116
50 - 54	13,352	6,820	5,297	3,598	9,992	75,274	11	16	10	2	20	149
55 - 59	3,229	2,384	1,577	867	1,829	22,105	5	5	4	4	6	72
60 - 64	1,323	1,075	778	335	531	8,448	0	3	1	2	4	60
65 - 69	149	180	133	59	106	2,054	2	1	0	0	1	27
70 - 99	18	22	9	5	7	567	0	0	0	0	0	21
Total	234,464	125,392	115,289	102,055	155,875	926,326	72	76	69	43	111	732

Table 56: Females, Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	2,340	932	666	1,102	1,191	4,847	1	0	1	0	0	0
15 - 19	192	205	169	245	266	2,478	0	0	0	0	0	0
20 - 24	923	825	767	710	643	2,335	1	0	0	0	0	0
25 - 29	1,211	1,055	1,382	1,728	1,526	5,160	0	0	0	0	0	0
30 - 34	1,179	1,149	1,436	1,761	1,944	9,003	1	1	0	0	1	4
35 - 39	1,163	1,189	1,393	1,595	2,140	12,408	1	0	0	0	1	1
40 - 44	1,109	1,033	1,296	1,480	2,120	13,597	1	0	1	0	0	5
45 - 49	990	898	1,151	1,083	1,708	12,750	2	4	0	3	0	13
50 - 54	1,012	936	1,099	1,043	1,341	10,144	0	0	1	0	0	12
55 - 59	647	576	631	577	722	6,643	0	1	0	0	3	7
60 - 64	433	353	361	305	364	5,814	1	0	0	1	0	18
65 - 69	37	47	75	82	107	2,259	1	0	0	0	1	25
70 - 99	1	2	5	6	20	1,011	0	0	0	0	0	19
Total	11,237	9,200	10,431	11,717	14,092	88,449	9	6	3	4	6	104

Table 57: Females, Non-Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	22,953	24,190	22,747	20,758	24,231	119,815	6	4	3	2	0	7
15 - 19	4,746	4,688	3,849	3,535	4,160	40,483	0	0	0	3	1	3
20 - 24	20,419	13,660	12,233	10,593	9,251	32,544	1	1	0	0	1	7
25 - 29	34,335	15,849	17,080	16,678	18,983	65,887	3	3	2	4	3	16
30 - 34	39,532	17,629	16,639	13,911	19,765	132,702	5	7	4	5	4	42
35 - 39	41,773	19,416	17,490	13,292	22,854	154,958	10	5	1	2	5	43
40 - 44	40,303	19,375	16,097	11,356	19,975	144,693	4	6	8	4	10	67
45 - 49	32,038	16,491	12,879	8,476	14,787	111,579	5	13	8	8	9	90
50 - 54	16,979	10,716	7,489	4,769	8,783	72,261	2	10	5	13	9	82
55 - 59	5,865	4,269	2,671	1,285	2,200	22,975	3	9	6	2	5	69
60 - 64	2,761	2,167	1,350	553	923	9,535	1	1	1	2	3	30
65 - 69	236	350	205	76	172	2,059	2	0	0	1	1	5
70 - 99	20	18	12	7	20	489	0	0	0	0	0	5
Total	261,960	148,818	130,741	105,289	146,104	909,980	42	59	38	46	51	466

Table 58: Males, Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	895	982	915	739	1,287	6,905	0	0	0	0	1	1
15 - 19	195	165	163	177	274	3,650	0	0	0	0	0	0
20 - 24	589	328	406	380	442	3,420	4	0	0	0	0	2
25 - 29	1,092	864	899	992	1,229	5,136	4	1	1	0	0	2
30 - 34	1,115	1,047	1,067	1,456	1,829	9,490	3	1	0	1	1	4
35 - 39	1,163	1,199	1,377	1,831	2,057	14,873	1	4	1	1	1	11
40 - 44	1,048	1,084	1,360	1,663	1,990	20,020	7	2	0	0	0	28
45 - 49	814	753	949	1,359	1,383	23,231	4	9	1	1	4	24
50 - 54	549	538	693	995	824	20,977	5	5	1	1	2	46
55 - 59	399	397	341	478	501	11,953	0	7	2	0	0	49
60 - 64	303	261	213	272	242	6,885	1	2	2	3	0	37
65 - 69	73	77	62	80	78	2,809	0	0	2	0	0	39
70 - 99	0	0	3	1	0	1,640	0	0	0	0	0	44
Total	8,235	7,695	8,448	10,423	12,136	130,989	29	31	10	7	9	287

Table 59: Males, Non-Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	26,691	25,222	26,242	24,217	21,478	153,942	1	0	1	0	0	8
15 - 19	5,407	3,419	3,804	3,625	3,321	53,800	1	1	1	0	1	6
20 - 24	15,466	12,900	10,283	9,945	8,668	48,390	3	2	5	2	4	22
25 - 29	20,660	23,082	12,371	13,871	14,014	89,103	3	9	6	7	9	47
30 - 34	18,000	31,610	12,920	13,258	13,058	130,460	8	11	5	6	2	37
35 - 39	17,317	36,745	15,480	14,422	13,145	165,355	7	14	13	6	8	100
40 - 44	17,074	37,330	15,311	13,627	10,772	162,165	6	23	11	7	8	125
45 - 49	14,124	29,941	12,308	9,947	7,792	134,493	12	25	19	10	16	161
50 - 54	7,688	16,758	7,988	6,140	4,130	88,785	18	28	17	10	13	200
55 - 59	3,686	4,432	2,984	2,060	1,152	29,724	6	5	11	6	4	113
60 - 64	1,579	1,575	1,305	869	394	8,913	0	2	4	5	0	51
65 - 69	267	325	294	214	80	2,264	0	2	0	1	2	27
70 - 99	11	27	40	9	8	616	0	0	0	0	0	16
Total	147,970	223,366	121,330	112,204	98,012	1,068,010	65	122	93	60	67	913

Table 60: Females, Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	707	812	781	601	1,022	5,256	0	0	0	0	0	0
15 - 19	183	113	155	157	223	2,636	0	0	0	0	0	1
20 - 24	875	639	600	552	512	2,587	0	1	0	0	0	1
25 - 29	1,047	982	992	1,249	1,544	5,656	0	1	0	1	0	2
30 - 34	1,019	1,048	1,085	1,353	1,771	9,878	1	0	0	0	2	3
35 - 39	983	965	1,113	1,341	1,602	13,471	3	2	0	1	0	6
40 - 44	939	894	998	1,255	1,419	15,270	0	2	0	0	0	7
45 - 49	930	835	874	1,165	1,152	14,440	2	10	4	1	1	10
50 - 54	1,005	882	865	1,023	971	11,652	1	2	1	0	2	12
55 - 59	720	704	548	699	707	7,641	3	0	3	0	0	8
60 - 64	561	554	380	402	361	6,491	0	4	1	1	0	14
65 - 69	104	124	100	106	96	2,577	0	0	0	1	0	10
70 - 99	0	1	2	7	6	1,218	0	1	0	0	0	18
Total	9,073	8,553	8,493	9,910	11,386	98,773	10	23	9	5	5	92

Table 61: Females, Non-Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	24,106	22,416	22,510	21,467	19,451	130,212	0	7	1	1	3	6
15 - 19	5,055	3,554	3,962	3,461	3,245	44,378	1	1	0	0	2	3
20 - 24	19,461	14,439	10,966	9,507	7,858	40,933	6	3	1	5	2	10
25 - 29	23,282	29,570	15,262	16,691	16,248	100,612	2	15	5	4	3	23
30 - 34	22,264	38,023	16,987	16,219	14,015	153,668	0	6	3	3	2	30
35 - 39	22,753	40,609	18,870	17,123	12,981	171,561	4	7	13	8	8	57
40 - 44	23,735	40,335	19,592	16,145	11,450	159,711	7	5	9	4	1	67
45 - 49	21,651	34,794	17,628	13,787	8,887	128,154	6	17	15	4	14	107
50 - 54	14,006	20,531	12,069	8,661	5,472	83,066	8	4	7	4	8	111
55 - 59	7,244	8,120	5,441	3,275	1,707	30,368	4	4	8	3	7	65
60 - 64	3,569	3,420	2,667	1,617	665	10,316	2	6	8	3	3	32
65 - 69	582	648	569	318	113	2,285	0	2	1	1	0	9
70 - 99	15	31	40	15	9	454	0	1	0	0	0	19
Total	187,723	256,490	146,563	128,286	102,101	1,055,718	40	78	71	40	53	539

(b)   Top 4 Companies

Table 62: Males, Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,725	1,627	1,214	1,568	1,395	3,840	0	0	1	0	0	0
15 - 19	474	438	307	416	451	1,886	0	0	0	0	0	0
20 - 24	1,212	1,033	636	679	587	1,558	1	0	0	0	0	1
25 - 29	1,700	1,619	1,030	1,223	1,396	3,331	0	0	0	1	1	2
30 - 34	2,516	1,969	1,291	1,588	1,828	7,388	0	0	0	1	1	2
35 - 39	2,840	2,402	1,599	2,140	2,180	11,940	2	2	1	2	0	3
40 - 44	2,350	2,271	1,611	2,537	2,415	16,168	1	3	2	2	2	9
45 - 49	1,475	1,428	1,193	2,244	1,839	16,865	0	3	2	0	2	14
50 - 54	593	780	599	1,321	1,102	10,501	0	3	3	3	1	20
55 - 59	289	453	306	625	762	6,498	0	3	1	5	3	24
60 - 64	102	135	98	125	260	3,132	3	0	1	4	4	23
65 - 69	15	29	23	24	64	1,495	0	1	1	0	0	16
70 - 99	0	0	1	1	2	704	0	0	0	0	0	18
Total	15,291	14,184	9,908	14,491	14,281	85,306	7	15	12	18	14	132

Table 63: Males, Non-Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	33,443	36,252	34,629	28,130	23,054	65,465	1	4	3	1	5	5
15 - 19	8,692	7,494	7,039	5,563	4,956	21,391	2	3	2	1	1	2
20 - 24	18,655	19,740	18,284	13,110	11,223	22,303	12	12	6	11	4	16
25 - 29	19,198	19,800	19,335	16,574	17,630	52,434	6	7	4	7	7	15
30 - 34	27,125	19,187	17,156	15,198	16,404	81,822	4	5	4	8	3	49
35 - 39	24,268	18,414	16,502	14,978	15,144	84,159	5	11	10	11	9	44
40 - 44	17,133	14,152	13,549	13,078	12,219	71,760	12	13	9	21	13	72
45 - 49	10,657	8,945	9,040	9,707	8,756	46,293	15	9	11	14	5	58
50 - 54	2,681	2,836	3,345	3,760	3,383	19,262	2	5	6	15	9	50
55 - 59	641	1,026	1,277	1,081	912	6,720	5	4	6	8	4	38
60 - 64	124	219	262	291	381	1,974	1	2	1	1	10	14
65 - 69	21	22	11	9	88	479	0	0	0	0	1	9
70 - 99	3	1	2	4	46	134	0	0	0	0	2	3
Total	162,641	148,088	140,431	121,483	114,196	474,196	65	75	62	98	73	375

Table 64: Females, Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,378	1,141	965	1,150	1,126	2,900	0	0	0	0	0	1
15 - 19	464	387	242	361	337	1,240	0	0	0	0	0	1
20 - 24	1,444	1,232	818	776	656	1,174	0	0	0	2	0	0
25 - 29	1,786	1,460	1,059	1,330	1,372	3,663	0	0	2	0	0	0
30 - 34	1,841	1,646	1,105	1,472	1,641	7,023	0	2	0	0	0	4
35 - 39	1,887	1,704	1,248	1,729	1,806	8,539	0	0	0	1	1	0
40 - 44	1,573	1,430	1,133	1,794	1,757	8,477	0	1	0	0	1	2
45 - 49	1,083	1,136	909	1,580	1,463	7,122	1	1	0	0	2	6
50 - 54	716	1,001	737	1,234	1,015	4,211	0	0	2	1	3	5
55 - 59	385	684	494	950	1,244	3,984	1	1	0	1	3	10
60 - 64	111	216	152	239	411	2,171	0	0	0	1	2	8
65 - 69	27	82	39	54	79	902	0	0	0	0	1	5
70 - 99	0	1	2	9	6	454	0	0	0	0	0	12
Total	12,695	12,120	8,903	12,678	12,913	51,860	2	5	4	6	13	54

Table 65: Females, Non-Medical, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	29,430	31,284	29,427	24,083	19,416	52,517	3	7	1	3	0	3
15 - 19	7,808	7,080	6,427	5,096	4,404	16,473	1	1	0	1	1	2
20 - 24	20,280	23,106	20,810	15,445	12,663	19,121	2	3	2	2	3	3
25 - 29	19,604	21,152	21,612	20,006	21,534	58,838	1	3	5	5	6	16
30 - 34	22,557	20,528	18,775	17,614	18,677	80,639	2	4	4	12	1	23
35 - 39	19,675	19,602	18,285	16,891	18,687	75,930	3	6	2	9	5	25
40 - 44	15,218	15,840	15,896	15,219	15,155	60,366	2	4	5	6	8	38
45 - 49	9,238	10,263	10,550	10,620	10,760	38,510	6	6	5	7	11	30
50 - 54	2,640	3,371	4,106	4,292	4,496	16,184	0	2	9	6	4	20
55 - 59	981	1,593	2,057	1,630	1,418	5,791	2	3	4	2	3	11
60 - 64	197	263	367	480	661	1,426	0	0	0	2	3	4
65 - 69	14	23	13	22	221	387	0	0	1	0	2	5
70 - 99	5	1	0	4	116	118	0	0	0	1	2	4
Total	147,647	154,106	148,325	131,402	128,208	426,300	22	39	38	56	49	184

Table 66: Males, Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,581	1,699	1,478	1,120	1,406	4,814	0	0	0	0	0	4
15 - 19	404	351	401	299	423	2,357	0	0	0	0	0	0
20 - 24	1,229	953	808	517	568	1,946	0	0	0	0	0	0
25 - 29	2,025	1,564	1,480	974	1,097	3,935	0	0	1	0	0	1
30 - 34	2,066	2,361	1,751	1,152	1,433	8,328	0	2	1	1	0	1
35 - 39	2,171	2,948	2,236	1,509	1,890	13,031	1	1	2	1	1	6
40 - 44	1,649	2,442	2,218	1,586	2,404	17,990	0	1	4	2	0	10
45 - 49	957	1,551	1,476	1,238	2,241	18,552	3	3	2	1	1	21
50 - 54	579	796	856	672	1,451	12,967	1	1	0	1	4	29
55 - 59	270	310	467	313	728	7,488	0	0	1	1	3	17
60 - 64	83	122	165	120	164	3,691	0	0	0	0	0	24
65 - 69	16	28	42	38	30	1,695	0	2	0	0	1	23
70 - 99	0	1	0	1	1	823	0	0	0	0	0	39
Total	13,030	15,126	13,378	9,539	13,836	97,617	5	10	11	7	10	175

Table 67: Males, Non-Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	27,307	30,933	33,619	32,606	26,554	82,131	0	2	4	2	0	9
15 - 19	8,003	5,809	6,223	6,585	5,455	27,511	3	2	3	0	1	4
20 - 24	17,831	16,169	15,829	15,266	10,520	26,846	8	7	5	2	4	13
25 - 29	17,392	16,995	19,046	19,199	16,422	62,161	5	8	6	6	4	20
30 - 34	16,202	24,813	17,708	16,592	14,629	92,483	11	10	6	10	5	40
35 - 39	13,532	24,140	17,707	16,150	14,685	98,844	7	11	12	8	10	54
40 - 44	9,577	18,038	14,487	13,952	12,943	87,161	10	17	22	15	24	78
45 - 49	5,571	11,530	9,597	9,494	10,110	59,019	8	13	9	13	12	84
50 - 54	1,717	3,883	3,812	4,298	4,666	27,254	4	6	12	8	10	67
55 - 59	577	713	1,061	1,383	1,268	8,271	2	0	2	3	2	36
60 - 64	108	188	293	370	394	2,633	0	2	1	1	1	27
65 - 69	10	25	31	16	22	656	0	0	0	0	0	5
70 - 99	4	6	2	2	4	174	0	0	0	0	0	5
Total	117,831	153,242	139,415	135,913	117,672	575,144	58	78	82	68	73	442

Table 68: Females, Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	1,264	1,336	1,019	900	1,045	3,692	0	0	0	0	0	0
15 - 19	435	339	309	226	345	1,588	0	2	0	1	0	0
20 - 24	1,571	1,278	972	646	589	1,513	0	1	0	0	0	0
25 - 29	1,806	1,713	1,389	1,068	1,306	4,246	0	0	0	0	0	1
30 - 34	1,603	1,911	1,515	1,070	1,338	8,039	0	0	1	0	0	4
35 - 39	1,406	1,960	1,637	1,222	1,642	10,076	0	0	1	0	1	2
40 - 44	1,200	1,742	1,509	1,091	1,780	10,232	0	1	1	2	0	1
45 - 49	890	1,098	1,109	963	1,489	8,669	0	0	0	1	1	8
50 - 54	779	899	1,047	733	1,288	5,559	0	1	1	2	4	9
55 - 59	386	431	718	528	1,053	5,092	0	1	0	2	1	10
60 - 64	119	146	246	184	310	2,877	0	0	0	1	0	13
65 - 69	19	45	100	56	62	1,116	0	2	0	1	2	5
70 - 99	0	2	2	2	7	536	0	0	0	0	0	6
Total	11,478	12,900	11,572	8,689	12,254	63,235	0	8	4	10	9	59

Table 69: Females, Non-Medical, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	24,842	27,090	29,062	27,637	22,805	66,921	2	5	2	1	4	3
15 - 19	7,000	5,508	5,866	5,816	4,843	21,544	4	2	2	0	2	4
20 - 24	18,318	17,575	19,015	16,683	11,708	23,493	0	1	0	3	1	4
25 - 29	16,524	18,438	21,679	22,473	20,453	71,651	0	2	3	2	5	16
30 - 34	14,637	21,810	19,774	18,305	17,089	95,595	4	3	7	0	4	29
35 - 39	12,926	19,728	19,471	18,266	16,638	93,557	3	7	6	8	8	44
40 - 44	10,186	15,933	16,333	16,214	15,424	78,298	0	8	4	6	6	34
45 - 49	6,449	10,013	11,032	11,199	11,177	51,426	1	7	4	8	12	45
50 - 54	2,225	3,630	4,507	5,263	5,497	25,119	2	4	6	7	2	31
55 - 59	869	1,120	1,714	2,185	1,836	7,659	0	5	2	3	4	21
60 - 64	182	299	429	575	622	2,270	0	1	1	4	5	15
65 - 69	7	26	31	17	47	575	0	0	0	1	0	5
70 - 99	4	6	1	1	5	200	0	0	0	0	1	3
Total	114,169	141,176	148,914	144,634	128,144	538,308	16	45	37	43	54	254

Table 70: Males, Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	774	1,461	1,561	1,366	1,028	5,200	0	0	0	0	1	2
15 - 19	245	327	332	411	304	2,676	0	0	1	0	1	1
20 - 24	775	905	694	621	409	2,250	0	0	0	0	0	1
25 - 29	1,437	1,762	1,401	1,385	889	3,935	1	1	0	0	0	2
30 - 34	1,717	2,011	2,024	1,597	1,046	7,662	0	0	0	0	1	2
35 - 39	1,863	2,153	2,788	2,131	1,406	11,480	0	1	1	1	3	9
40 - 44	1,618	1,669	2,453	2,255	1,539	15,985	1	0	1	2	0	7
45 - 49	1,119	1,026	1,686	1,613	1,289	16,653	1	1	2	1	2	22
50 - 54	732	624	936	953	776	13,137	1	0	2	1	4	21
55 - 59	356	323	320	479	353	7,449	0	0	2	1	1	31
60 - 64	116	116	148	215	145	4,011	0	0	0	2	4	24
65 - 69	17	27	29	59	43	1,697	0	0	1	0	0	25
70 - 99	0	0	6	1	2	869	0	0	0	0	1	22
Total	10,769	12,404	14,378	13,086	9,229	93,004	4	3	10	8	18	169

Table 71: Males, Non-Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	27,559	25,060	28,494	31,666	30,409	99,477	5	6	4	1	4	7
15 - 19	7,112	5,257	4,555	5,768	6,134	33,489	4	4	1	1	0	8
20 - 24	14,864	14,453	13,060	13,067	12,458	31,214	10	5	2	7	5	12
25 - 29	15,403	15,225	15,305	18,627	18,917	68,744	6	1	7	10	7	24
30 - 34	14,832	13,984	21,263	16,480	15,901	99,313	6	3	6	3	7	30
35 - 39	14,779	12,637	23,800	17,414	15,676	112,977	3	3	15	12	4	60
40 - 44	11,885	9,198	18,398	14,614	14,060	103,286	6	8	16	8	8	89
45 - 49	7,463	5,758	12,170	10,056	9,963	75,839	6	10	15	10	11	94
50 - 54	2,842	2,087	5,174	4,763	5,097	40,211	3	4	7	14	11	99
55 - 59	1,288	629	762	1,136	1,597	11,704	2	1	1	0	5	42
60 - 64	389	173	239	378	516	4,192	0	2	2	0	4	34
65 - 69	18	17	30	29	17	1,002	0	0	0	0	1	10
70 - 99	7	3	9	4	4	312	0	0	0	0	1	8
Total	118,441	104,481	143,259	134,002	130,749	681,760	51	47	76	66	68	517

Table 72: Females, Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	617	1,167	1,228	960	831	3,975	0	0	0	0	0	0
15 - 19	315	323	249	279	233	1,878	0	0	0	0	0	0
20 - 24	1,035	1,236	996	728	465	1,740	0	1	0	0	0	0
25 - 29	1,394	1,776	1,520	1,356	1,019	4,406	0	0	0	0	1	1
30 - 34	1,329	1,607	1,897	1,416	1,055	7,595	1	0	1	0	0	1
35 - 39	1,198	1,418	1,876	1,606	1,130	9,807	0	0	0	0	0	1
40 - 44	1,125	1,253	1,766	1,503	1,147	10,380	0	0	1	1	0	7
45 - 49	846	874	1,161	1,166	920	8,644	1	0	0	0	3	8
50 - 54	828	901	961	1,038	777	6,014	0	0	0	1	0	3
55 - 59	500	435	471	766	565	5,254	0	0	0	3	0	14
60 - 64	143	175	178	303	243	3,526	1	1	1	3	0	7
65 - 69	23	35	54	151	77	1,213	0	1	0	0	1	14
70 - 99	0	0	5	4	3	637	0	0	0	0	0	8
Total	9,353	11,200	12,362	11,276	8,465	65,069	3	3	3	8	5	64

Table 73: Females, Non-Medical, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	24,733	22,772	24,737	27,310	25,765	82,239	2	5	4	2	1	4
15 - 19	6,035	4,763	4,414	5,225	5,575	26,581	0	1	0	1	4	0
20 - 24	16,389	15,244	13,991	14,957	12,677	27,372	2	0	1	2	0	2
25 - 29	16,666	15,569	17,712	22,299	22,672	80,836	1	1	7	3	3	10
30 - 34	16,412	13,552	20,276	18,851	17,780	107,728	0	4	4	4	3	28
35 - 39	16,054	12,510	19,503	19,023	17,805	110,873	1	7	9	2	6	42
40 - 44	14,077	10,168	16,391	16,503	16,468	97,209	5	7	7	7	14	62
45 - 49	9,788	6,808	10,736	11,505	11,859	67,456	2	4	9	8	10	71
50 - 54	4,243	2,818	4,721	5,544	6,399	37,543	0	3	2	2	2	50
55 - 59	2,100	936	1,211	1,813	2,405	11,583	0	0	6	6	6	23
60 - 64	638	285	421	603	865	4,050	0	1	2	0	3	10
65 - 69	21	20	45	35	20	925	0	0	0	0	0	5
70 - 99	8	6	7	4	2	273	0	0	0	0	0	6
Total	127,164	105,451	134,165	143,672	140,292	654,668	13	33	51	37	52	313

Table 74: Males, Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	935	741	1,355	1,464	1,268	5,505	1	0	1	1	0	0
15 - 19	236	182	284	324	403	2,918	0	0	0	0	0	0
20 - 24	647	570	685	580	528	2,591	0	0	0	1	1	3
25 - 29	1,113	1,245	1,560	1,267	1,173	4,021	0	0	0	0	1	3
30 - 34	1,255	1,592	1,914	1,839	1,501	7,707	1	1	0	3	0	4
35 - 39	1,522	1,790	2,009	2,712	1,983	11,811	1	1	0	3	3	8
40 - 44	1,308	1,546	1,725	2,527	2,231	16,130	0	0	1	4	2	12
45 - 49	772	1,166	1,069	1,846	1,739	17,520	0	0	4	1	0	21
50 - 54	616	802	674	1,095	1,062	15,209	2	2	1	3	2	15
55 - 59	236	356	328	320	505	7,584	0	1	1	0	0	21
60 - 64	79	157	140	171	252	4,690	0	1	0	1	0	24
65 - 69	11	30	39	45	77	1,909	0	0	0	1	3	21
70 - 99	0	1	0	7	4	984	0	0	0	0	0	21
Total	8,730	10,178	11,782	14,197	12,726	98,579	5	6	8	18	12	153

Table 75: Males, Non-Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	28,703	25,403	22,973	27,163	29,700	118,175	4	3	3	2	4	7
15 - 19	6,484	4,750	3,877	4,272	5,648	40,243	0	1	1	2	1	5
20 - 24	12,920	12,973	12,089	11,915	10,721	37,540	8	12	10	8	6	18
25 - 29	13,112	14,181	14,408	14,682	17,891	76,619	5	3	5	8	5	34
30 - 34	14,000	13,348	12,856	19,378	15,845	106,695	5	5	5	10	1	36
35 - 39	15,381	13,846	12,030	23,431	17,062	124,276	4	6	10	14	12	61
40 - 44	13,348	11,803	9,216	18,508	14,846	116,907	7	3	13	23	14	91
45 - 49	9,365	7,887	6,131	12,572	10,747	89,170	10	5	13	22	10	99
50 - 54	4,508	3,642	2,608	6,095	5,758	53,094	5	3	11	18	10	109
55 - 59	1,484	1,174	600	866	1,278	14,354	6	2	3	3	4	60
60 - 64	582	515	231	272	488	5,695	1	2	2	0	1	17
65 - 69	61	77	34	50	44	1,282	0	1	0	0	0	24
70 - 99	5	7	3	7	1	371	0	0	0	0	0	9
Total	119,953	109,606	97,056	139,211	130,029	784,421	55	46	76	110	68	570

Table 76: Females, Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	756	585	1,084	1,150	890	4,252	0	0	0	1	0	0
15 - 19	266	212	237	238	265	2,106	0	0	0	0	0	0
20 - 24	884	857	955	781	567	1,945	0	0	0	0	0	1
25 - 29	1,033	1,309	1,689	1,435	1,273	4,540	0	0	0	0	0	1
30 - 34	1,071	1,258	1,587	1,785	1,352	7,792	0	0	1	1	0	1
35 - 39	1,068	1,182	1,445	1,953	1,563	10,522	0	0	0	1	1	6
40 - 44	911	1,096	1,291	1,778	1,507	11,294	0	1	0	0	1	7
45 - 49	695	879	885	1,261	1,217	9,719	1	1	1	0	0	11
50 - 54	768	918	920	1,033	1,039	7,410	0	1	0	2	0	11
55 - 59	383	491	458	479	831	5,344	0	0	0	1	0	6
60 - 64	132	206	216	234	382	4,235	0	1	0	0	0	11
65 - 69	13	40	55	70	170	1,572	0	0	0	0	0	6
70 - 99	0	1	2	10	8	745	0	0	0	0	0	15
Total	7,980	9,034	10,824	12,207	11,064	71,476	1	4	2	6	2	76

Table 77: Females, Non-Medical, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	24,662	22,729	20,707	23,403	25,539	98,195	3	6	3	4	2	17
15 - 19	5,655	4,381	3,791	4,057	5,036	32,558	0	0	0	0	0	4
20 - 24	14,638	13,883	12,621	11,207	11,454	32,580	1	3	3	0	2	12
25 - 29	14,862	15,683	15,267	17,670	22,213	90,035	1	2	2	0	7	11
30 - 34	16,356	15,388	12,776	19,056	18,222	119,575	4	7	9	3	3	32
35 - 39	17,377	15,573	12,086	19,808	18,848	126,603	3	4	10	6	4	56
40 - 44	16,452	14,122	10,325	16,889	16,946	114,890	9	2	5	7	8	54
45 - 49	12,521	10,385	7,145	11,559	12,266	83,432	3	4	3	9	9	70
50 - 54	6,656	5,333	3,564	6,058	6,773	51,431	2	0	4	10	4	77
55 - 59	2,421	2,109	979	1,354	1,889	15,134	0	0	1	1	0	25
60 - 64	1,043	869	393	526	832	6,224	0	0	0	2	2	13
65 - 69	98	99	44	84	49	1,275	0	0	0	1	0	5
70 - 99	5	9	4	6	0	294	0	0	0	0	0	4
Total	132,746	120,563	99,702	131,677	140,067	772,226	26	28	40	43	41	380

Table 78: Males, Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	737	849	654	1,262	1,366	5,986	0	0	0	0	0	0
15 - 19	164	174	146	266	341	3,201	0	0	0	1	0	1
20 - 24	435	481	434	529	470	2,901	1	0	0	1	1	1
25 - 29	928	890	1,011	1,322	1,140	4,401	3	0	0	0	2	2
30 - 34	1,033	979	1,313	1,744	1,608	8,084	0	0	1	2	0	3
35 - 39	1,146	1,239	1,602	1,886	2,523	12,513	1	2	1	0	1	13
40 - 44	907	1,191	1,424	1,703	2,619	17,097	2	3	0	0	1	12
45 - 49	588	712	1,121	1,128	2,098	18,866	2	0	1	3	0	12
50 - 54	408	559	811	721	1,305	16,768	3	1	0	2	2	29
55 - 59	188	230	361	323	356	8,412	1	0	0	0	0	21
60 - 64	69	96	171	174	189	5,393	1	0	1	1	2	31
65 - 69	7	19	45	54	65	2,131	0	1	0	0	0	29
70 - 99	1	0	2	0	8	1,123	0	0	0	0	0	28
Total	6,611	7,419	9,095	11,112	14,088	106,876	14	7	4	10	9	182

Table 79: Males, Non-Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	20,957	25,363	23,152	21,437	25,741	134,522	3	1	2	0	2	11
15 - 19	4,959	4,003	3,596	3,360	4,005	45,805	2	1	3	1	3	14
20 - 24	13,686	11,365	10,729	10,108	8,997	38,380	4	4	8	5	6	14
25 - 29	22,900	11,230	12,705	13,459	14,055	51,783	5	7	3	3	12	31
30 - 34	28,149	11,225	11,596	11,897	16,314	106,135	7	5	1	4	3	37
35 - 39	30,904	12,670	12,385	11,461	23,418	135,485	9	7	10	5	12	61
40 - 44	29,964	11,828	11,204	9,047	20,197	131,327	11	13	11	8	21	108
45 - 49	22,356	8,875	7,623	6,339	14,199	104,044	12	9	11	7	17	112
50 - 54	9,705	5,081	4,257	3,034	8,286	66,018	10	15	7	2	19	133
55 - 59	1,629	1,575	1,197	731	1,366	18,863	5	5	4	4	6	65
60 - 64	504	694	624	289	387	7,423	0	3	1	2	2	52
65 - 69	71	125	108	52	75	1,781	1	1	0	0	0	25
70 - 99	16	21	8	3	7	484	0	0	0	0	0	20
Total	185,800	104,055	99,184	91,217	137,047	842,050	69	71	61	41	103	683

Table 80: Females, Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	634	695	530	999	1,071	4,526	1	0	1	0	0	0
15 - 19	144	175	143	231	247	2,344	0	0	0	0	0	0
20 - 24	703	729	684	669	571	2,171	1	0	0	0	0	0
25 - 29	919	905	1,158	1,564	1,357	4,798	0	0	0	0	0	0
30 - 34	870	922	1,146	1,574	1,722	8,336	1	1	0	0	1	4
35 - 39	789	962	1,098	1,398	1,873	11,456	1	0	0	0	1	1
40 - 44	668	808	1,022	1,289	1,809	12,391	1	0	1	0	0	5
45 - 49	508	652	865	922	1,403	11,250	2	1	0	3	0	10
50 - 54	502	666	853	895	1,082	8,839	0	0	0	0	0	5
55 - 59	245	350	472	483	539	5,815	0	1	0	0	2	5
60 - 64	89	180	266	260	280	5,130	1	0	0	1	0	16
65 - 69	17	26	53	74	80	1,983	1	0	0	0	1	21
70 - 99	1	2	3	5	15	871	0	0	0	0	0	19
Total	6,089	7,072	8,293	10,363	12,049	79,910	9	3	2	4	5	86

Table 81: Females, Non-Medical, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	18,322	21,722	20,705	19,286	22,103	112,667	5	4	3	2	0	7
15 - 19	3,816	4,166	3,435	3,267	3,795	37,614	0	0	0	2	1	2
20 - 24	16,482	12,073	10,880	9,864	8,550	29,636	1	1	0	0	1	5
25 - 29	27,473	13,222	14,732	15,085	17,111	59,070	3	3	0	4	3	16
30 - 34	30,781	14,003	14,015	12,345	17,605	121,762	5	7	4	3	4	41
35 - 39	31,750	15,301	14,687	11,807	19,947	142,573	10	4	1	1	5	42
40 - 44	29,654	14,900	13,390	10,090	17,327	132,417	3	5	7	3	9	65
45 - 49	22,291	12,407	10,665	7,440	12,645	101,101	5	9	7	8	9	88
50 - 54	10,176	7,443	6,216	4,199	7,221	65,034	2	9	5	13	9	69
55 - 59	2,399	2,574	2,206	1,136	1,742	20,430	2	7	6	2	5	65
60 - 64	906	1,238	1,106	497	679	8,603	1	1	1	2	3	30
65 - 69	90	217	165	67	116	1,865	2	0	0	1	0	5
70 - 99	19	18	11	4	7	402	0	0	0	0	0	4
Total	194,159	119,284	112,213	95,087	128,848	833,174	39	50	34	41	49	439

Table 82: Males, Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	588	618	777	603	1,194	6,483	0	0	0	0	1	1
15 - 19	162	137	148	152	254	3,418	0	0	0	0	0	0
20 - 24	492	259	368	326	402	3,183	4	0	0	0	0	2
25 - 29	902	709	794	852	1,135	4,672	4	1	1	0	0	2
30 - 34	944	866	904	1,229	1,639	8,493	3	1	0	1	1	3
35 - 39	968	987	1,170	1,571	1,809	13,528	1	3	1	0	1	8
40 - 44	843	888	1,182	1,404	1,754	18,200	7	1	0	0	0	15
45 - 49	633	578	783	1,160	1,215	20,552	4	9	1	1	3	20
50 - 54	362	392	553	837	696	17,956	5	4	1	0	2	37
55 - 59	197	213	254	390	415	10,061	0	2	1	0	0	36
60 - 64	64	64	126	197	201	5,797	0	1	0	2	0	33
65 - 69	9	13	22	64	66	2,299	0	0	1	0	0	33
70 - 99	0	0	3	1	0	1,315	0	0	0	0	0	35
Total	6,164	5,724	7,084	8,786	10,780	115,957	28	22	6	4	8	225

Table 83: Males, Non-Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	19,750	18,495	23,569	22,068	19,962	144,850	1	0	1	0	0	8
15 - 19	4,474	2,721	3,398	3,237	3,039	49,888	1	1	1	0	1	6
20 - 24	12,326	11,043	9,267	9,046	8,074	44,160	3	2	5	2	4	20
25 - 29	15,685	18,485	10,492	12,159	12,866	82,121	3	7	6	6	8	41
30 - 34	13,188	25,443	10,576	11,206	11,568	119,480	6	10	4	4	2	36
35 - 39	12,052	29,046	12,377	11,995	11,310	150,128	3	11	11	5	8	96
40 - 44	11,716	29,685	12,173	11,282	9,265	147,465	5	18	9	7	8	110
45 - 49	9,438	23,141	9,583	8,220	6,612	119,832	7	20	17	8	16	147
50 - 54	4,806	12,193	6,080	4,962	3,472	77,988	14	23	12	8	11	184
55 - 59	1,915	2,379	1,908	1,569	973	25,393	3	4	8	6	4	104
60 - 64	553	608	807	681	345	7,751	0	1	4	4	0	49
65 - 69	105	129	192	168	67	1,944	0	1	0	1	2	24
70 - 99	11	24	38	8	6	519	0	0	0	0	0	15
Total	106,019	173,392	100,460	96,601	87,559	971,519	46	98	78	51	64	840

Table 84: Females, Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	461	540	637	500	939	4,929	0	0	0	0	0	0
15 - 19	151	96	133	132	204	2,475	0	0	0	0	0	1
20 - 24	728	497	550	504	486	2,399	0	0	0	0	0	1
25 - 29	867	792	887	1,082	1,416	5,220	0	1	0	1	0	2
30 - 34	820	843	918	1,117	1,608	9,107	1	0	0	0	1	3
35 - 39	747	761	938	1,104	1,424	12,355	2	1	0	1	0	6
40 - 44	701	672	822	1,037	1,240	13,865	0	1	0	0	0	5
45 - 49	592	547	646	906	1,001	12,835	2	9	1	1	1	7
50 - 54	614	499	636	835	853	10,090	1	1	1	0	1	11
55 - 59	293	287	401	536	580	6,595	2	0	0	0	0	6
60 - 64	89	109	201	301	314	5,748	0	2	0	1	0	11
65 - 69	13	19	47	82	90	2,261	0	0	0	1	0	7
70 - 99	0	1	2	6	6	1,063	0	1	0	0	0	15
Total	6,076	5,663	6,818	8,142	10,161	88,942	8	16	2	5	3	75

Table 85: Females, Non-Medical, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	17,726	16,146	20,133	19,533	18,071	121,888	0	6	1	1	3	5
15 - 19	3,964	2,892	3,504	3,107	2,986	41,271	1	1	0	0	2	3
20 - 24	14,796	11,583	9,745	8,453	7,336	37,750	5	2	1	4	2	10
25 - 29	17,175	23,542	12,887	14,520	14,763	93,645	2	13	5	3	3	23
30 - 34	15,531	29,556	13,672	13,684	12,507	141,806	0	5	3	3	1	28
35 - 39	14,834	30,753	14,930	14,429	11,478	156,889	3	5	8	7	8	53
40 - 44	14,874	29,421	15,139	13,405	10,207	145,770	5	5	9	4	1	65
45 - 49	12,869	24,111	13,293	11,449	7,768	115,841	4	14	10	3	12	96
50 - 54	7,252	12,320	8,385	7,160	4,811	74,394	4	3	7	3	8	100
55 - 59	3,022	3,331	3,231	2,690	1,505	26,870	1	1	5	2	7	57
60 - 64	1,096	1,066	1,444	1,312	595	9,209	0	0	5	3	3	29
65 - 69	194	203	320	249	101	2,038	0	2	1	1	0	9
70 - 99	15	30	38	13	4	365	0	1	0	0	0	14
Total	123,348	184,954	116,721	110,004	92,132	967,736	25	58	55	34	50	492

15.2   Policies with 100% Acceleration on Critical Illness

This set of data is only available for the top 4 companies: AIA, Prudential, NTUC Income and Great Eastern Life.

Table 86: Males, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	7,826	7,724	5,682	2,971	1,309	1,076	0	0	1	0	0	0
15 - 19	2,600	2,787	2,579	1,525	879	686	0	0	2	0	0	0
20 - 24	4,649	5,810	5,814	4,218	2,896	2,457	1	2	3	4	0	2
25 - 29	4,713	6,613	6,724	6,003	5,724	7,585	1	1	1	2	3	0
30 - 34	4,571	7,050	6,762	6,435	7,150	12,884	0	3	0	3	2	6
35 - 39	4,051	6,595	6,169	5,974	6,956	12,428	2	3	3	1	3	5
40 - 44	2,792	4,854	4,589	4,491	5,451	9,771	4	2	3	3	3	4
45 - 49	1,553	3,055	2,681	2,676	3,338	5,746	1	3	1	2	3	3
50 - 54	540	1,065	904	1,053	1,237	2,251	0	1	4	1	3	6
55 - 59	239	486	425	438	436	699	0	3	2	0	2	2
60 - 64	8	65	65	49	93	182	0	0	0	1	1	0
65 - 69	0	0	0	1	0	7	0	0	0	0	0	0
70 - 99	0	0	0	0	0	0	0	0	0	0	0	0
Total	33,542	46,104	42,394	35,834	35,469	55,772	9	18	20	17	20	28

Table 87: Females, 1997

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	7,034	6,714	4,981	2,625	1,154	947	1	1	0	0	0	0
15 - 19	2,601	2,803	2,331	1,378	763	614	1	1	0	0	0	0
20 - 24	6,322	8,606	8,273	5,805	3,785	2,594	1	1	0	2	0	0
25 - 29	5,514	8,380	8,746	8,179	8,426	11,461	0	1	1	1	2	2
30 - 34	5,367	8,444	8,326	7,974	8,558	14,554	1	4	1	4	1	2
35 - 39	4,971	8,263	7,755	7,331	8,583	13,873	0	1	1	0	1	3
40 - 44	3,884	6,865	6,511	6,258	6,945	11,177	0	2	0	0	2	3
45 - 49	2,463	4,507	4,290	4,192	4,661	7,044	0	5	3	3	1	3
50 - 54	872	1,699	1,656	1,769	1,865	2,873	0	0	1	0	0	0
55 - 59	381	819	712	794	785	1,190	2	0	0	1	1	0
60 - 64	14	81	99	92	170	267	0	0	0	0	0	0
65 - 69	0	0	0	0	0	8	0	0	0	0	0	0
70 - 99	0	0	0	0	0	0	0	0	0	0	0	0
Total	39,423	57,181	53,680	46,397	45,695	66,602	6	16	7	11	8	13

Table 88: Males, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	6,981	7,342	7,081	5,282	2,703	2,102	0	0	1	0	0	0
15 - 19	2,202	1,994	2,386	2,213	1,313	1,359	1	0	0	0	0	0
20 - 24	3,767	4,037	4,856	5,036	3,423	3,869	4	3	1	1	1	2
25 - 29	4,120	4,520	6,328	6,478	5,638	11,185	1	2	3	4	2	2
30 - 34	3,842	4,226	6,518	6,537	6,066	18,587	1	3	0	4	1	5
35 - 39	3,716	3,876	6,433	6,240	5,952	19,217	2	1	5	3	1	4
40 - 44	2,812	2,907	4,938	4,824	4,675	16,008	3	2	3	2	4	7
45 - 49	1,842	1,662	3,237	2,916	2,889	9,799	1	4	2	0	3	9
50 - 54	759	648	1,302	1,204	1,264	4,259	1	2	3	2	3	2
55 - 59	302	275	540	464	495	1,326	0	0	0	1	2	2
60 - 64	17	41	115	104	79	378	0	0	0	0	0	1
65 - 69	0	0	0	0	1	19	0	0	0	0	0	0
70 - 99	0	0	0	0	0	0	0	0	0	0	0	0
Total	30,360	31,528	43,734	41,298	34,498	88,108	14	17	18	17	17	34

Table 89: Females, 1998

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	6,373	6,551	6,159	4,623	2,410	1,866	0	2	0	0	0	0
15 - 19	2,224	1,980	2,304	1,908	1,128	1,209	2	0	1	0	1	0
20 - 24	4,894	5,552	7,062	6,797	4,305	3,971	0	1	0	0	0	1
25 - 29	4,641	5,557	8,450	8,934	8,172	17,655	0	2	1	0	1	3
30 - 34	4,570	5,236	8,074	8,087	7,713	22,409	0	0	1	0	1	3
35 - 39	4,425	5,000	8,143	7,917	7,342	22,391	1	2	3	1	0	4
40 - 44	3,808	4,127	7,050	6,726	6,451	19,074	0	3	0	3	0	6
45 - 49	2,702	2,674	4,869	4,589	4,449	12,564	1	0	0	1	1	0
50 - 54	1,170	1,162	2,105	2,148	2,227	5,955	1	1	2	3	2	3
55 - 59	501	460	910	808	896	2,275	0	1	0	0	1	2
60 - 64	24	57	165	159	148	622	0	0	0	0	0	0
65 - 69	0	0	0	0	0	29	0	0	0	0	0	0
70 - 99	0	0	0	0	0	0	0	0	0	0	0	0
Total	35,332	38,356	55,291	52,696	45,241	110,020	5	12	8	8	7	22

Table 90: Males, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	6,935	6,514	6,849	6,626	4,884	4,367	2	1	1	0	2	0
15 - 19	1,923	1,702	1,680	2,206	1,828	2,247	1	1	0	0	0	1
20 - 24	3,004	3,264	3,522	4,218	4,408	5,499	1	1	1	3	2	0
25 - 29	3,514	3,873	4,346	6,137	6,250	14,486	2	0	1	2	2	3
30 - 34	3,600	3,549	3,888	6,229	6,203	22,576	1	0	0	0	2	8
35 - 39	3,546	3,632	3,858	6,528	6,270	24,994	0	0	1	4	1	6
40 - 44	2,628	2,828	3,006	5,188	5,061	21,332	1	2	1	2	2	10
45 - 49	1,567	2,001	1,805	3,494	3,097	13,660	1	1	2	3	5	13
50 - 54	571	884	775	1,654	1,512	6,695	1	0	2	4	3	11
55 - 59	236	362	312	592	530	2,174	0	0	0	1	1	1
60 - 64	17	56	68	171	145	630	0	2	1	1	2	0
65 - 69	1	0	0	0	0	56	0	0	0	0	0	0
70 - 99	2	0	0	0	0	0	0	0	0	0	0	0
Total	27,544	28,665	30,109	43,043	40,188	118,716	10	8	10	20	22	53

Table 91: Females, 1999

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	6,259	5,965	5,951	5,738	4,244	3,838	2	2	1	0	0	0
15 - 19	1,909	1,723	1,678	2,053	1,667	2,019	0	1	0	0	0	0
20 - 24	4,056	4,294	4,625	5,710	5,232	5,421	1	0	0	0	0	0
25 - 29	4,552	4,553	5,626	8,701	9,006	22,821	1	1	0	1	1	4
30 - 34	4,323	4,447	5,030	7,895	7,892	28,988	0	0	0	1	0	3
35 - 39	4,227	4,427	4,972	8,120	7,855	29,845	0	1	2	1	0	4
40 - 44	3,372	3,889	4,296	7,313	6,987	26,219	2	0	0	1	5	7
45 - 49	2,210	2,887	2,887	5,235	4,898	18,375	0	0	0	0	2	8
50 - 54	945	1,497	1,430	2,625	2,660	9,814	0	0	0	0	0	6
55 - 59	420	574	547	1,035	946	3,574	0	0	0	2	0	5
60 - 64	26	105	116	297	252	1,199	0	0	0	1	0	1
65 - 69	0	0	0	0	1	85	0	0	0	0	0	0
70 - 99	2	0	0	0	0	0	0	0	0	0	0	0
Total	32,301	34,361	37,158	54,722	51,640	152,198	6	5	3	7	8	38

Table 92: Males, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	8,838	6,615	6,100	6,509	6,105	8,359	1	0	3	2	1	2
15 - 19	2,046	1,486	1,384	1,531	2,038	3,539	0	0	1	1	0	1
20 - 24	2,917	2,743	2,925	3,170	3,688	7,942	0	1	2	2	3	7
25 - 29	3,225	3,310	3,645	4,124	5,717	17,916	2	2	0	2	0	6
30 - 34	2,951	3,363	3,334	3,778	5,821	26,467	2	2	1	3	1	6
35 - 39	3,128	3,479	3,500	3,903	6,374	30,642	1	1	4	1	4	10
40 - 44	2,346	2,679	2,848	3,159	5,361	26,688	1	0	2	3	6	13
45 - 49	1,439	1,734	2,095	1,958	3,701	18,054	0	0	2	4	2	11
50 - 54	630	697	1,079	952	1,992	9,730	2	3	3	1	0	14
55 - 59	208	251	369	320	605	2,986	0	1	1	0	0	5
60 - 64	15	62	99	108	248	1,033	0	1	0	1	0	3
65 - 69	0	0	0	0	0	116	0	0	0	0	0	1
70 - 99	0	2	0	0	0	0	0	0	0	0	0	0
Total	27,743	26,421	27,378	29,512	41,650	153,472	9	11	19	20	17	79

Table 93: Females, 2000

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	7,555	5,894	5,549	5,621	5,241	7,286	0	2	0	1	0	2
15 - 19	2,131	1,542	1,457	1,564	1,848	3,235	0	0	0	0	0	0
20 - 24	4,320	3,651	3,641	3,758	4,456	7,648	0	0	0	0	1	2
25 - 29	3,998	4,357	4,510	5,764	8,501	27,839	1	0	1	0	2	3
30 - 34	3,660	4,247	4,177	4,891	7,613	35,537	1	2	3	1	0	5
35 - 39	3,727	4,275	4,283	5,075	8,044	37,230	0	1	3	1	1	6
40 - 44	3,278	3,537	3,964	4,420	7,451	33,827	1	0	0	1	5	3
45 - 49	2,200	2,453	3,024	3,053	5,596	24,767	1	0	2	1	3	10
50 - 54	1,027	1,202	1,794	1,799	3,168	14,900	0	0	1	1	2	6
55 - 59	344	428	610	597	1,096	4,958	0	0	0	0	0	2
60 - 64	35	106	187	187	413	1,927	0	0	0	0	1	1
65 - 69	0	0	0	0	1	212	0	0	0	0	0	0
70 - 99	0	2	0	0	0	0	0	0	0	0	0	0
Total	32,275	31,694	33,196	36,729	53,428	199,366	4	5	10	6	15	40

Table 94: Males, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	6,001	8,437	6,190	5,764	6,118	13,151	0	0	0	0	1	1
15 - 19	1,355	1,625	1,225	1,215	1,423	5,038	1	0	0	0	1	1
20 - 24	2,428	2,693	2,496	2,666	2,723	9,323	0	0	3	2	1	2
25 - 29	2,932	3,051	3,103	3,414	3,903	20,506	3	1	2	1	5	6
30 - 34	2,594	2,832	3,061	3,266	3,693	29,808	1	0	2	1	0	6
35 - 39	2,532	2,972	3,439	3,454	3,774	35,750	1	2	1	0	2	9
40 - 44	1,910	2,440	2,787	2,858	3,233	32,451	0	1	1	2	2	11
45 - 49	1,165	1,526	1,773	2,237	2,062	23,242	1	1	0	0	2	13
50 - 54	564	736	819	1,228	1,115	13,339	2	1	1	1	3	13
55 - 59	168	251	285	422	351	4,115	1	0	0	0	1	5
60 - 64	6	44	87	150	137	1,656	0	0	0	0	2	1
65 - 69	0	0	0	0	0	220	0	0	0	0	0	1
70 - 99	0	0	2	0	0	1	0	0	0	0	0	0
Total	21,655	26,607	25,267	26,674	28,532	188,600	10	6	10	7	20	69

Table 95: Females, 2001

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	5,168	7,134	5,525	5,222	5,261	11,332	0	1	0	0	0	0
15 - 19	1,415	1,759	1,305	1,278	1,416	4,688	0	0	0	0	0	0
20 - 24	3,641	3,877	3,033	3,039	2,919	8,821	1	0	0	1	0	2
25 - 29	3,721	4,005	4,227	4,453	5,663	31,016	0	2	0	0	1	9
30 - 34	3,233	3,655	4,122	4,163	4,840	41,880	0	1	0	1	1	3
35 - 39	3,139	3,687	4,270	4,248	5,007	44,308	0	1	0	1	2	5
40 - 44	2,603	3,364	3,568	3,978	4,475	41,744	0	1	2	0	0	9
45 - 49	1,920	2,432	2,654	3,158	3,322	32,229	0	1	3	3	1	11
50 - 54	897	1,264	1,405	2,069	2,018	20,334	0	0	1	0	0	8
55 - 59	275	393	491	701	675	6,976	0	0	0	1	2	2
60 - 64	18	84	169	277	267	3,070	0	0	0	0	0	6
65 - 69	0	0	0	0	0	386	0	0	0	0	0	0
70 - 99	0	0	2	0	0	0	0	0	0	0	0	0
Total	26,030	31,654	30,771	32,586	35,863	246,784	1	7	6	7	7	55

Table 96: Males, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	5,432	5,720	7,905	5,897	5,325	17,634	0	0	0	0	0	1
15 - 19	1,282	1,107	1,467	1,126	1,084	5,947	0	0	1	0	0	2
20 - 24	2,265	2,262	2,420	2,267	2,300	9,691	2	1	2	0	2	8
25 - 29	2,709	2,765	2,817	2,870	3,148	20,955	0	0	0	2	0	6
30 - 34	2,151	2,592	2,743	2,978	3,164	30,532	0	0	1	1	0	4
35 - 39	1,786	2,475	2,775	3,363	3,259	37,465	0	1	0	1	2	10
40 - 44	1,334	2,113	2,446	2,814	2,914	35,406	0	0	0	0	0	19
45 - 49	822	1,276	1,551	1,927	2,247	26,655	1	3	1	1	2	22
50 - 54	343	645	860	974	1,331	15,668	0	1	0	2	2	7
55 - 59	140	235	303	330	532	5,765	0	1	0	3	1	18
60 - 64	8	22	87	123	184	2,082	0	0	0	1	0	10
65 - 69	0	0	0	0	0	332	0	0	0	0	0	0
70 - 99	0	0	0	2	0	6	0	0	0	0	0	0
Total	18,272	21,212	25,374	24,671	25,488	208,138	3	7	5	11	9	107

Table 97: Females, 2002

Age	Inforce Policies						Deaths					
	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+
0 - 14	4,774	4,896	6,651	5,224	4,852	15,151	0	1	0	0	0	2
15 - 19	1,286	1,221	1,557	1,201	1,189	5,616	0	0	0	0	1	1
20 - 24	3,413	3,117	3,299	2,536	2,444	9,012	0	0	0	0	0	3
25 - 29	3,273	3,723	4,033	4,050	4,284	30,084	0	1	0	0	0	7
30 - 34	2,540	3,350	3,636	4,156	4,046	44,995	0	0	0	1	0	5
35 - 39	2,226	3,088	3,524	4,185	4,105	47,836	1	1	4	2	0	14
40 - 44	1,818	2,845	3,336	3,695	3,951	45,956	1	1	1	0	0	8
45 - 49	1,237	2,109	2,590	2,827	3,282	37,285	1	0	1	0	1	20
50 - 54	696	1,069	1,455	1,617	2,246	24,304	0	1	0	0	2	9
55 - 59	219	397	494	575	906	9,652	0	0	0	0	0	5
60 - 64	14	58	139	245	357	4,072	0	0	3	0	0	3
65 - 69	0	0	0	0	1	609	0	0	0	0	0	0
70 - 99	0	0	0	2	0	7	0	0	0	0	0	0
Total	21,496	25,873	30,714	30,313	31,663	274,579	3	5	9	3	4	77

16 APPENDIX H: MORTALITY STUDY WORKGROUP

Mortality Study Workgroup Members:

<u>Fellow Members of Singapore Actuarial Society</u>

Patricia Chang	FSA	Great Eastern Life
Khoo Kah Siang	FIA	MAS
Lau Sok Hoon	FSA	Prudential
Eric Seah (Chairman)	FSA	Aviva Asia
Tan Hak Leh	FIA	MAS
Lawrence Tsui	FIAA	Swiss Re
Yip Kim Chee	FIA	Allianz

<u>Other Mortality Study Workgroup Members</u>

Sophia Lau	MAS
John Lim	MAS
Lim Pei Bin	MAS