

The New Zealand Society of Actuaries

**Report Into
The Mortality of New Zealand Insured Lives 2005 – 2007**

Abridged Version

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1 Introduction

This Mortality Investigation has been prepared for the Experience Committee of the NZ Society of Actuaries by Jonathan Eriksen of Eriksen & Associates Ltd. It has been peer reviewed by Graham Osborn of Bendzulla Actuarial Pty Ltd.

A previous investigation, entitled NZ04, for the years 2000 to 2004 was prepared by Peter Davies in February 2007 and covered the years 2000 to 2004 inclusive (NZ04). This report updates the results to the period 2005 to 2007 inclusive (NZ07).

2 Data

Data for the updated period were provided by the following twelve New Zealand Life Insurance companies.

- American International Assurance (AIA)
- AMP
- Asteron
- AXA
- BNZ Life
- Cigna
- Fidelity Life
- ING Life
- NBNZ Life
- Sovereign Assurance
- Tower Life
- Westpac Life

These are the same companies who supplied data to the previous mortality investigation prepared by Peter Davies in February 2007.

Data in respect of previous investigations were also supplied. This included in force and claims data from twenty one different Life Insurance companies covering 18 years. This has enabled an analysis of the improvement in mortality to be undertaken.

The numbers of policies analysed are summarised below:

Year to 31 Dec	In force		Claims
	Start	End	
1991	289,366	282,673	601
1992	299,103	290,472	666
1993	1,255,498	1,238,001	4,998
1994	1,398,735	1,379,977	5,351
1995	1,379,977	1,340,634	5,278
1996	1,311,326	1,357,849	5,259
1997	1,274,269	1,352,996	4,850
1998	1,226,067	1,261,774	4,289
1999	1,328,203	1,690,148	5,686
2000	1,694,013	1,713,948	6,613
2001	1,713,948	1,711,558	7,038
2002	1,580,378	1,584,617	6,413
2003	1,628,463	1,655,278	7,025
2004	1,655,278	1,696,723	6,788
2005	1,696,723	1,733,301	7,030
2006	1,733,301	1,770,827	7,256
2007	1,600,110	1,636,573	7,065

Note that the start of year in force is not necessarily equal to the end of the previous year in force as each year contains only those companies which provided complete data for the start of year, end of year, and claims for that year.

In particular, not all companies supplied end of 2007 data so the total reported exposed to risk declined from the previous year.

The data were checked for consistency on a year by year basis and against the data supplied in previous investigations.

3 Data Classifications - Experience Factors

The data provided included various categories of business, of which only the following seven were analysed: A description of each of these categories is given in Appendix 1.

- Traditional
- Unbundled
- Level Temporary
- Mortgage Repayment Insurance
- Other Term Policies
- Direct Marketing (guaranteed acceptance)
- Direct Marketing (other).

The following classes of business were excluded:

- policies with no or only nominal amounts of cover, e.g. insurance bonds with a nominal death benefit;
- policies issued on non-standard terms which do not involve a percentage extra mortality or age addition, (e.g. a contingent debt, an exclusion clause, a loading for hazardous activities or a constant dollar per thousand medical loading)
- reinsurances received from other companies
- children's deferred insurances
- policies which were issued as Industrial or Collector business
- group policies
- joint and contingent life policies
- accidental death benefits
- credit card insurances.

The following was provided for each policy:

- Date of Birth
- Date Commenced
- Sum Assured
- Sex Male or Female.
- Smoking Status Aggregate, Smoker, or Non-Smoker.
- Underwriting Basis Refer Appendix 2 for definitions. Since 76% of Policies were marked as Unknown, 16% as Non-Medical, and 8% for all other reasons combined, no further analysis was performed on this.
- HIV Tested Tested, Not Tested, Unknown. Since around 70% of policies were marked as Unknown, 29% as not tested, and 0.4% as Tested no further analysis was performed on this.
- Loading As a percentage.
- Date of Death Applies to Claims only.
- Cause of Death Applies to Claims only.

4 Methodology

In force and Claims files were provided as of 31 December 2004, 2005, 2006, and 2007.

The age and duration of the in force policies was calculated as Age Last and Curtate Duration. For consistency with this definition the age and duration for deaths was calculated as at 31 December of the year prior to death.

Note that an adjustment to the Exposed to Risk was made where a death claim is in respect of a policy that commenced during the calendar year of death. In these cases the duration is 0, rather than having a curtate duration of -1. This affected 204 policies.

The q-rate is the number of deaths divided by the Exposed to Risk. The Exposed to Risk is the sum of:

plus Number of Policies in force for the Whole Year;
plus ½ years exposure for Deaths during the Year;
plus ½ years exposure for Other Exits during the Year.

Using the following definitions

N_x^0 = Number of In force at the Start of the Year for age x
 N_x^1 = Number of In force at the End of the Year for age x
 d_x = Number of Deaths during the Year for age x (as at the start of the year)

then the standard formulae for calculating the q_x by a census method are:

$$m_x = \frac{2d_x}{(N_x^0 + N_x^1)} \quad (1)$$

and $q_x = \frac{m_x}{(1 + \frac{m_x}{2})} \quad (2)$

Appendix 3 shows an alternative formula calculated directly from the definitions.

The definition of age last at the start of the year means that the exact age at the commencement of the year varies from x exactly to almost (x+1). Assuming an even spread of birth dates, this means that the expected average age at the start of the year is $x+\frac{1}{2}$. There are three possible ways of handling this. The first is to use the average age; however, this is inconsistent with all current life tables which use exact ages. Hence this was rejected. The second option was to split the exposure over the year between x and (x+1). The third option is to adjust the age definition at the start of the year by $\frac{1}{2}$ year – this is, of course the same as using age x nearest.

For the purpose of this investigation the third option was chosen. For consistency with normal actuarial practice we use ‘age last’ throughout this report. Numerically age 40 last is the same as age $40\frac{1}{2}$ nearest.

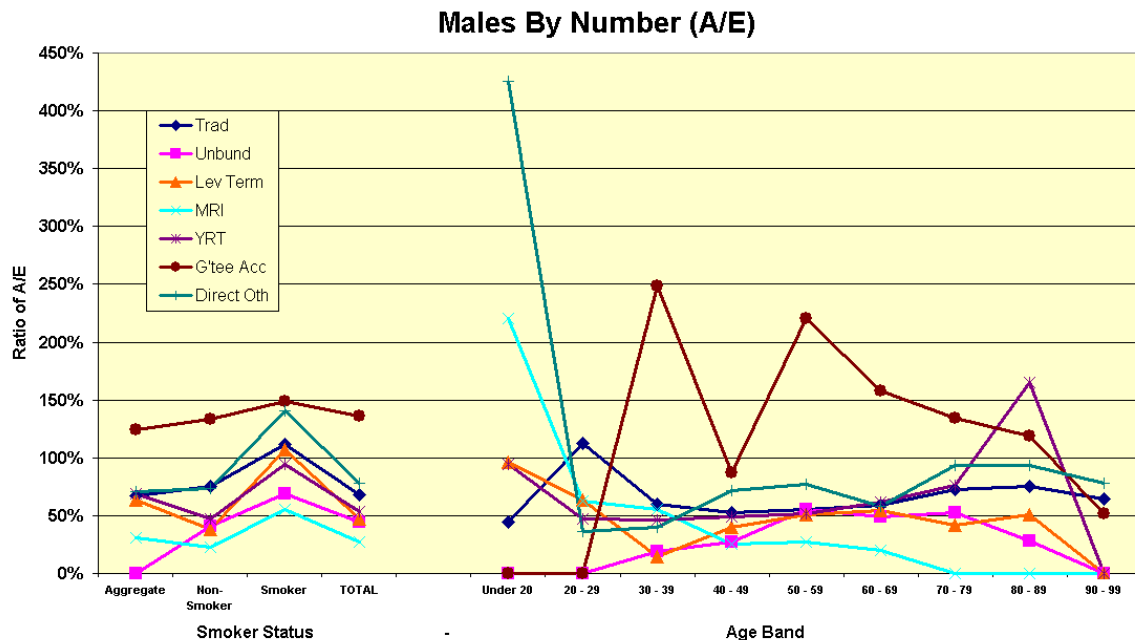
Note that this definition is the same as was used in the previous investigation.

The “expected” for loaded policies was based on the q_x for the life assured’s age multiplied by $(100 + \text{the loading as a percentage})/100$.

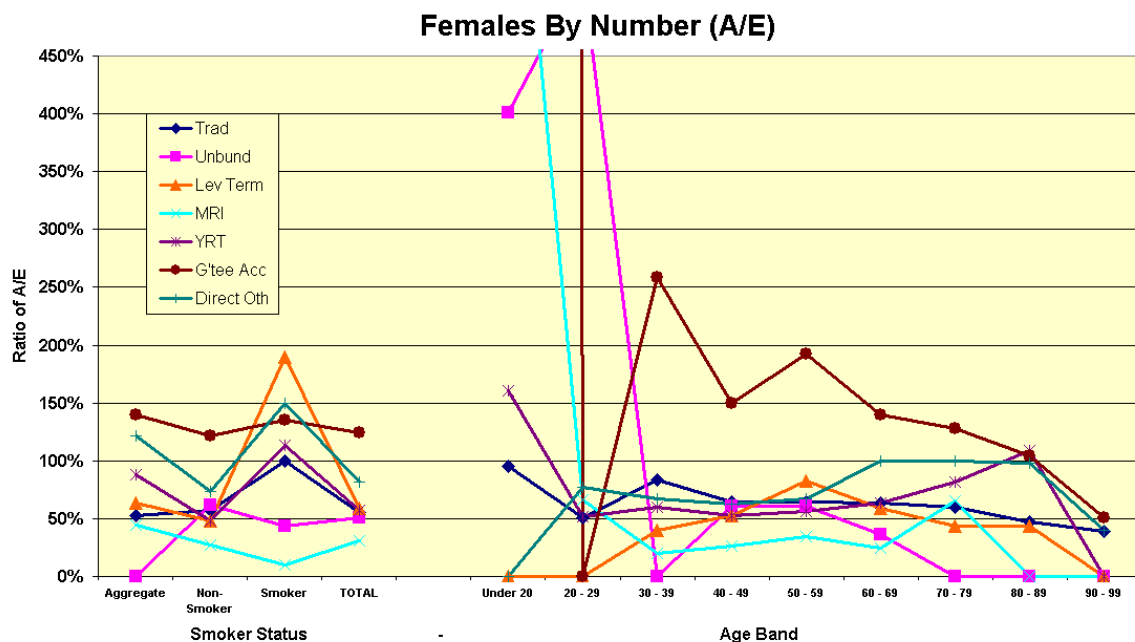
When checking the effect of selection curtate duration at the start of the year was used. This is different to the adjustment made for ages. The rationale behind this was to enable the duration 0 to have sufficient data to make a credible assessment of the select duration. A check was made using the curtate duration at start of year, end of year, and time of claim which was not inconsistent with the original conclusions. Once the length of the select period was determined a similar adjustment was made for duration as had been made for ages in determining the ultimate data. Note that with a census method, a high lapse rate may result in duration 0 q-rates being distorted (as early lapses are likely to have a selection effect) which can make determining the selection period problematical. Having all policies in force at any time during the year with the start and cease dates would remove any such distortions.

5 Results- Actual vs Expected Claims (A/E)

First we plot the results from the latest data against the expected claims assuming the mortality rates from the latest NZ Life Tables NZLT05-07 applied. A more detailed breakdown is shown in Appendix 6.

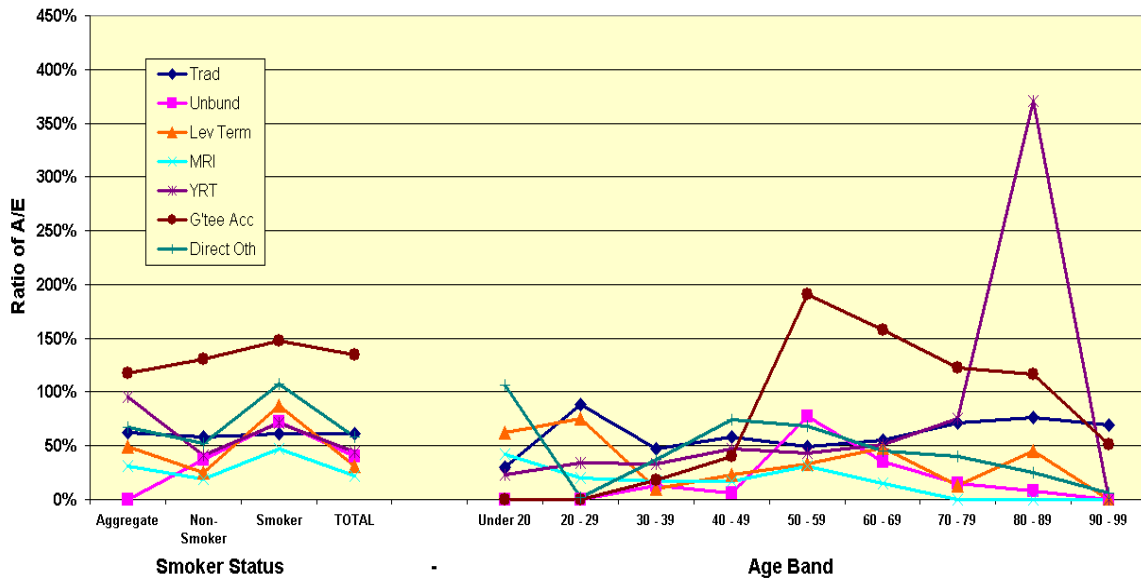


Note the clear increased mortality arising in respect of guaranteed direct business. Other direct business also seems to have experienced a higher claims ratio (actual to expected). Whilst this is to be expected intuitively, the consistency of the experience stands out.

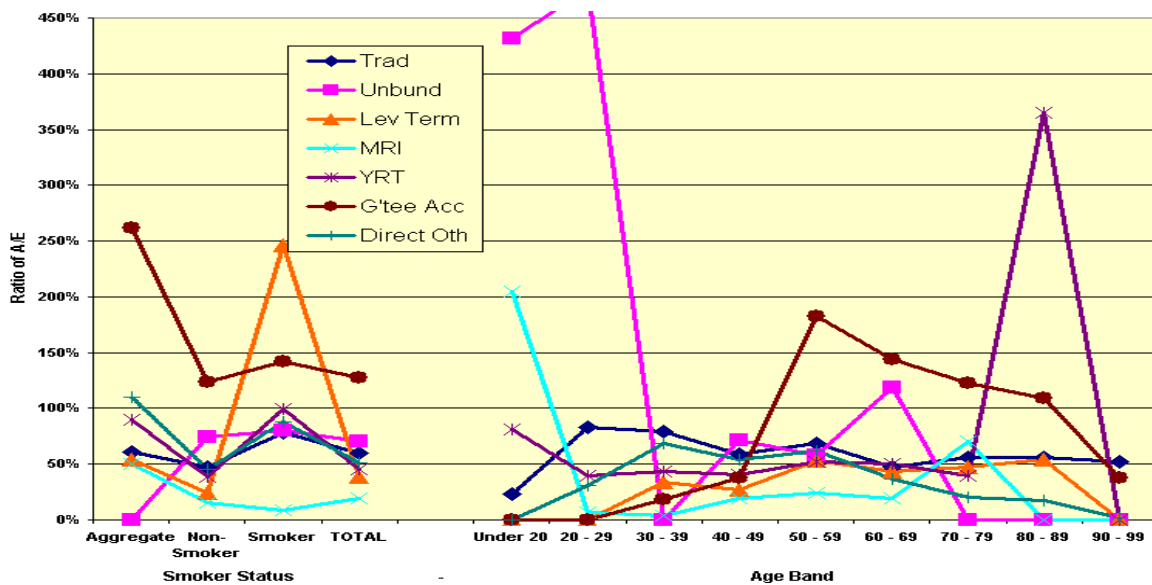


The female experience broadly matches the male experience especially for guaranteed direct business across age bands.

Males By Sum Assured (A/E)



Females By Sum Assured (A/E)



Only Traditional and Term policies have sufficient numbers for any analysis to be made. The loading for Traditional policies appears to be consistent with the unloaded policies (i.e. the actual to loaded expected is similar to unloaded ratios); however, the Term policies' loadings appear higher than necessary to cover the extra risk. Note that the exposed to risk for loaded policies are relatively small except for term policies (where about 10% are loaded) so detailed analysis was not practicable.

We note that this analysis uses the recorded loadings on the in-force and claims files. No check has been made from the claims file against the in-force policies. This means that the discrepancy in the Term policies might be due to the claims file not recording the loadings for policies in all cases.

A future area for investigation might be to match the claims file back to the in force and then update any missing loadings.

6 Graduation

The mortality data were supplied for 7 product types. For the purposes of graduation we have considered the following groups:

- Traditional Type 1;
- Term Types 3, 4, and 5
- Direct Guaranteed Type 6
- All Types 1, 3, 4, and 5 combined

We note that Unbundled and Direct (Other) have been omitted as they are small classes of business and it is not obvious which groups to aggregate. Note that for Term, the YRT comprises about 80% of the overall exposed to risk with level term and single premium MRI each being around 10% each. There did not appear to be a significant difference between YRT and the other two classes so the combined was used.

In each case the general process for graduating the raw q-rates was to fit a polynomial to the log of the q-rates. Generally the log of the raw rates was approximately linear. However, in most cases a cubic fitted the data better than either a line or a quadratic. A summary of the graduation statistics is attached in Appendix 10.

It was found that the shape of the curve meant that a single fit gave excellent results for the majority of ages, although for young and old ages some severe inconsistencies arose, for example a q-rate over 1 or an age 95 q-rate which was significantly less than the q-rate for a 90 year old.

For this reason the final graduation (except for Direct) was done in two parts— younger ages and older ages (the two age ranges overlapped, so were not exclusive). The two fitted curves were then smoothly blended across the common ages (this was achieved by linear combination over a 10 year period with the weighting varying from 0 to 1 over that period). We note that due to the lack of data for the youngest female ages for Traditional policies, that the curve was manually fitted by reference to the fitted rates for males. The exposed to risk, deaths, actual q-rates, and fitted q-rates are shown in Appendix 5.

Note that the data are sparse at the lower ages and it was not possible to ascertain the level of any accident hump that might be present. The shape of the raw data suggests that an accident hump is present (which is what would be expected) but not the level of such a hump. The presence of an accident hump is implied by the raw rates for ages 20-25 being higher than ages 25-30. However, scarcity of data precludes any credible estimate of the level and ages of such an accident hump.

Overall the graduated rates resulted in slightly higher rates than the raw data (i.e. expected claims using the graduated rates vs actual claims). This was due to the raw q-rates for ages with higher exposures being lighter than the ages around them. Fitting closer at these ages would have resulted in either a worse fit at the majority of ages or a “wavy” graduated set of rates neither of which were deemed acceptable. Note that the expected volatility of claims is more than this discrepancy (which equates to around one standard deviation).

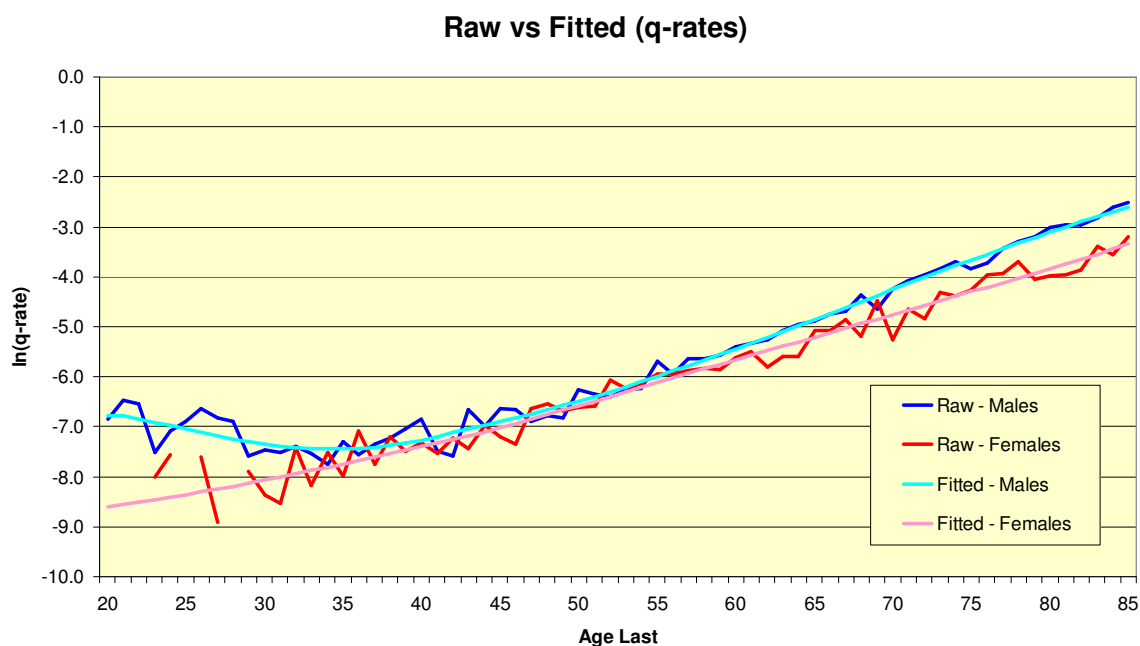
Combined Term and Traditional Policies

We considered all the Traditional and Term Data (i.e. the same as graduated in the past NZSA Mortality Study NZ04).

Note that in this investigation more data was available from term policies rather than traditional business. For males especially there was more than sufficient data except at the young and older ages for meaningful analysis.

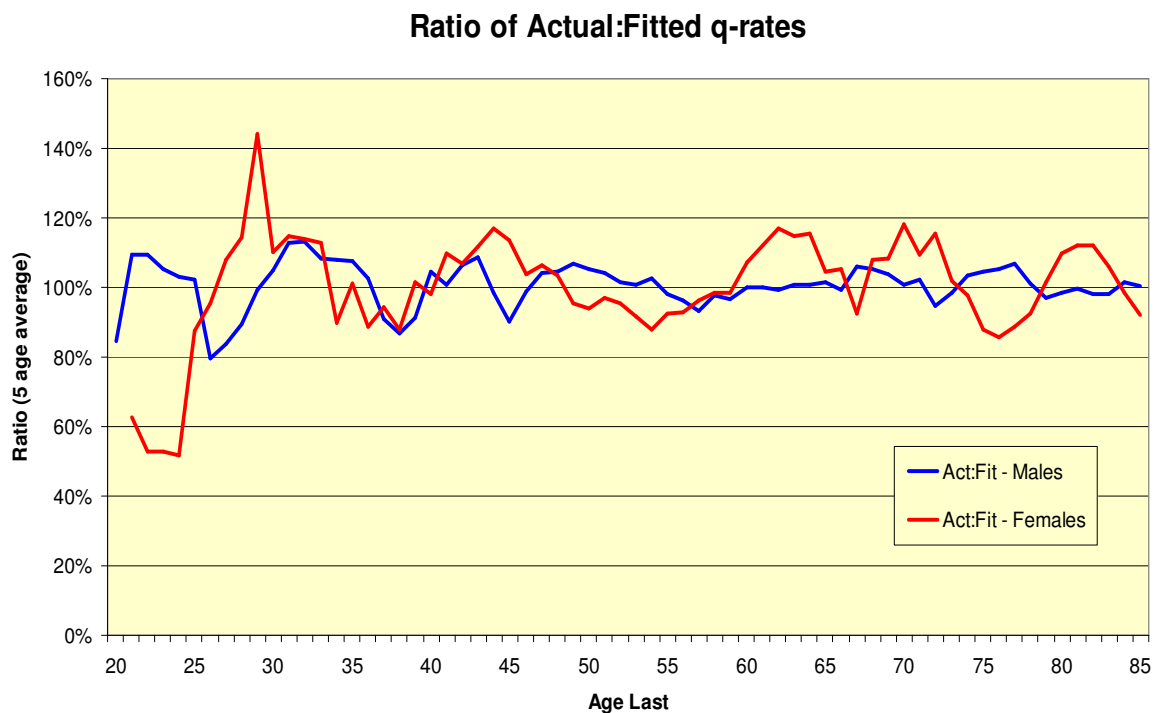
For term business both single premium and regular payment policies were combined.

The following graph summarises the raw and fitted log q-rates:

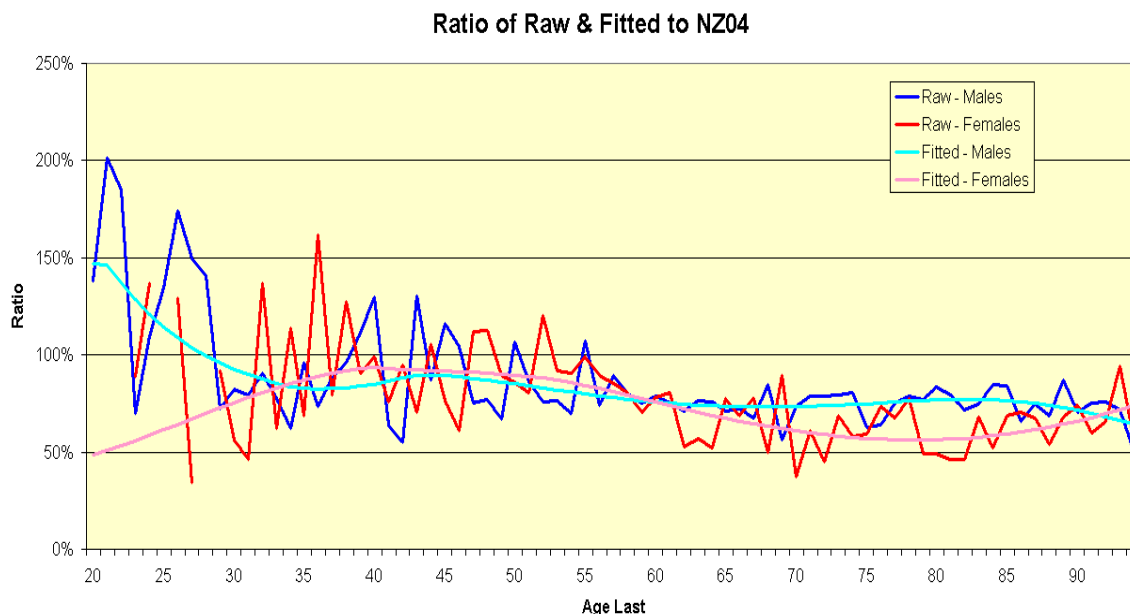


From the raw data a number of curves could be fitted. We could just as readily adjust the fitted curve to smooth the female fit at the youngest ages. The data are sparse at younger ages so there is more than one curve that would fit the data reasonably.

The ratio of the fitted rates to the raw rates (smoothed by taking quinquennial averages) is given below:

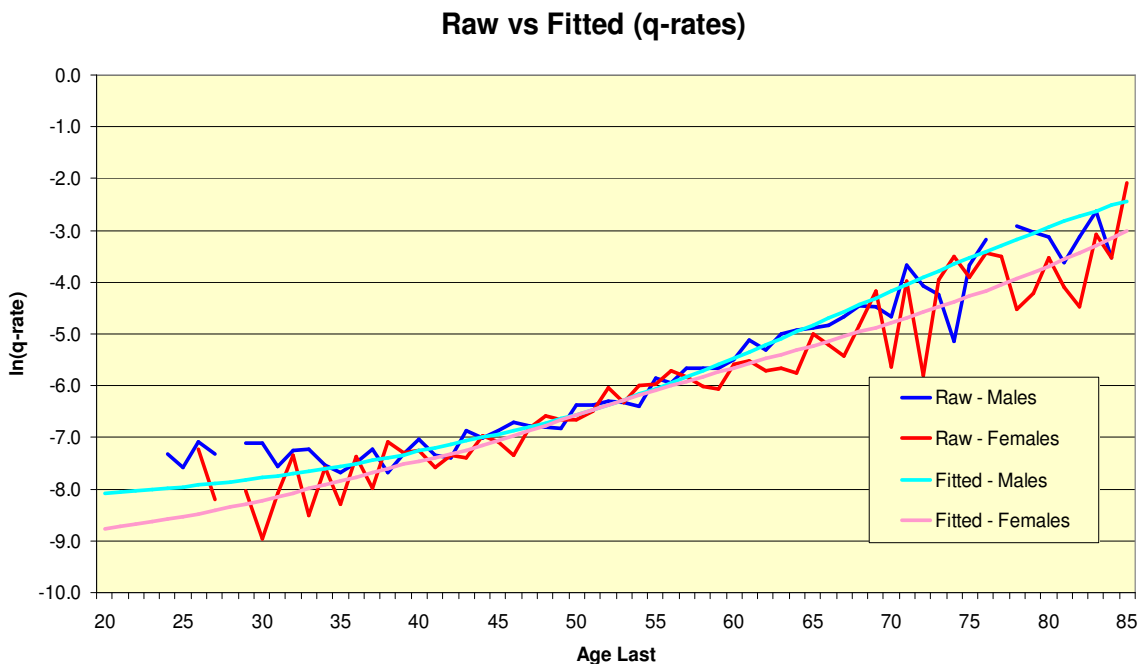


The following graph compares the raw and fitted curve against that produced in the last study. Of note is the improvement in the mortality rates over the three year period. Again there are a range of possible solutions for the shape of the curve at the youngest ages.



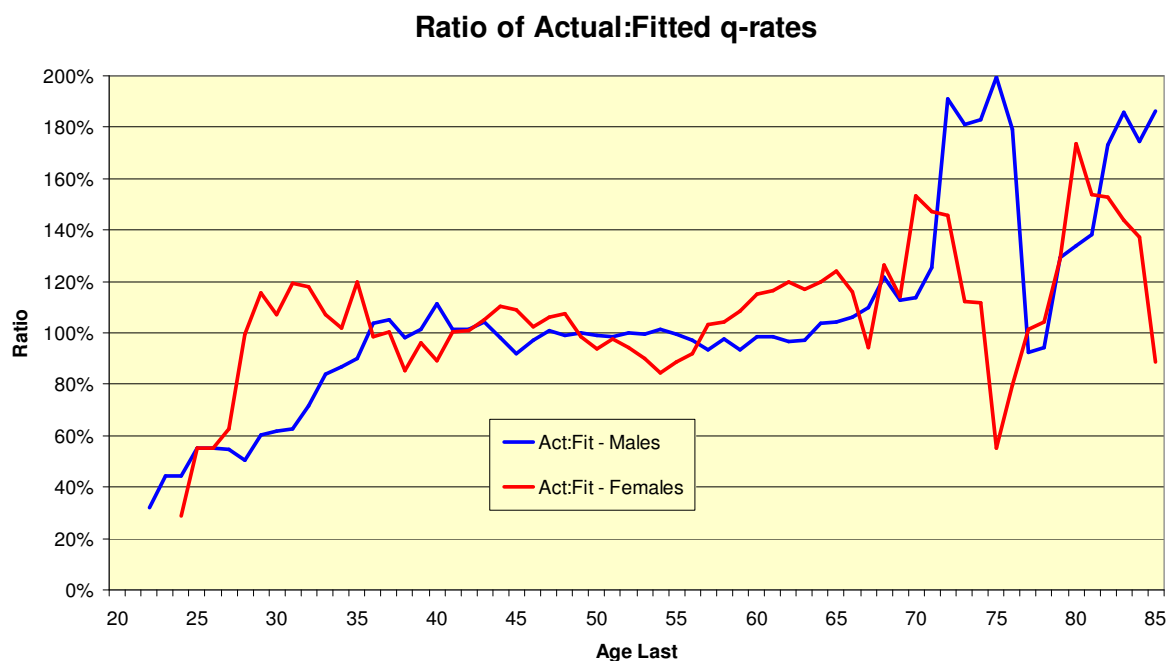
Term Policies

The following graph summarises the raw and fitted log q-rates:

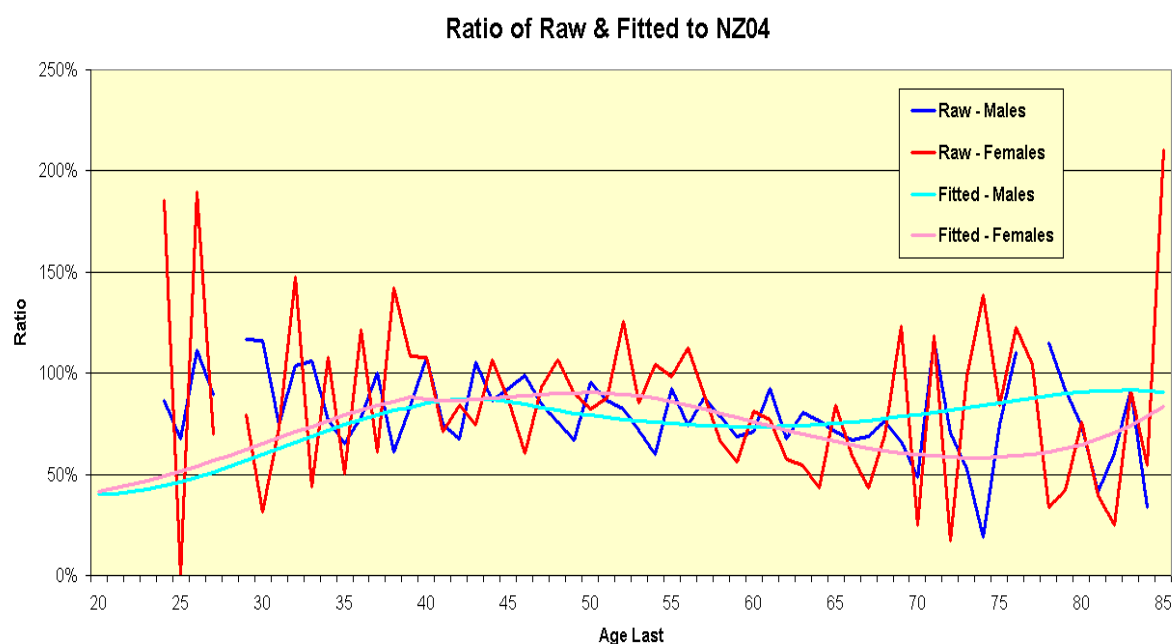


The above data are reasonably consistent between ages 35 and 70 and should thus be reliable over this age interval.

The ratio of the fitted rates to the raw rates (smoothed by taking 5 age averages) is given below:



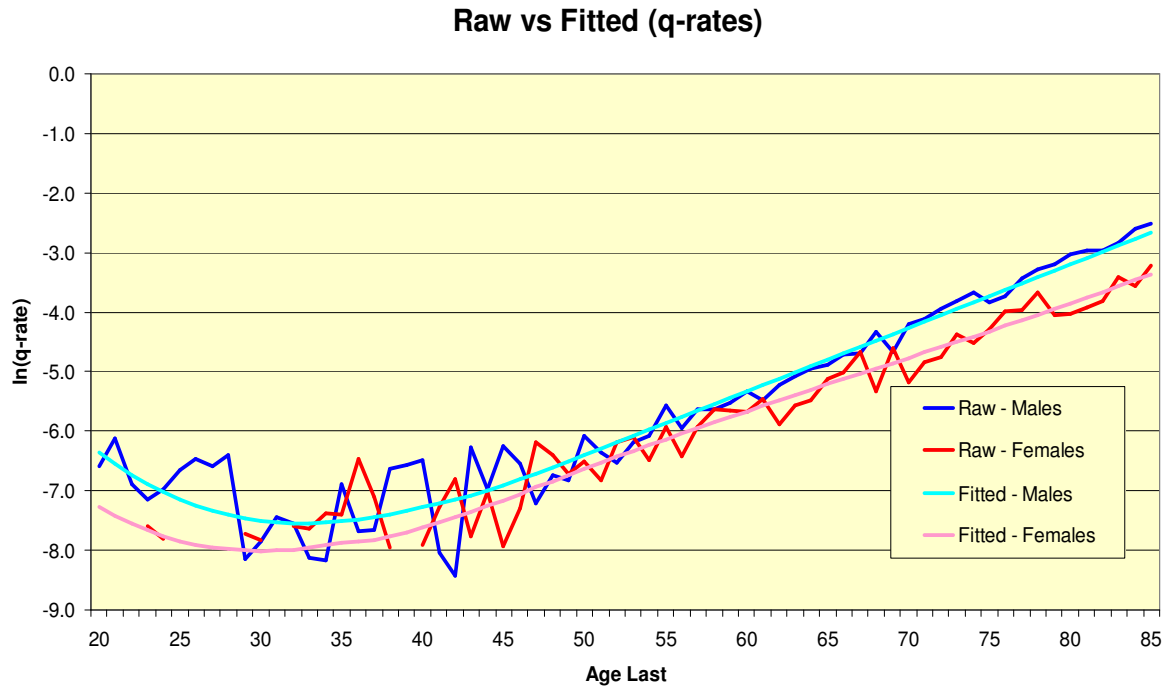
The following graph compares the raw and fitted curve against that produced in the last study. The shape of the curve is similar to last time but mortality has improved for term policies, especially for male lives. Also, there is some flexibility with regards the shape of the curve at the youngest ages.



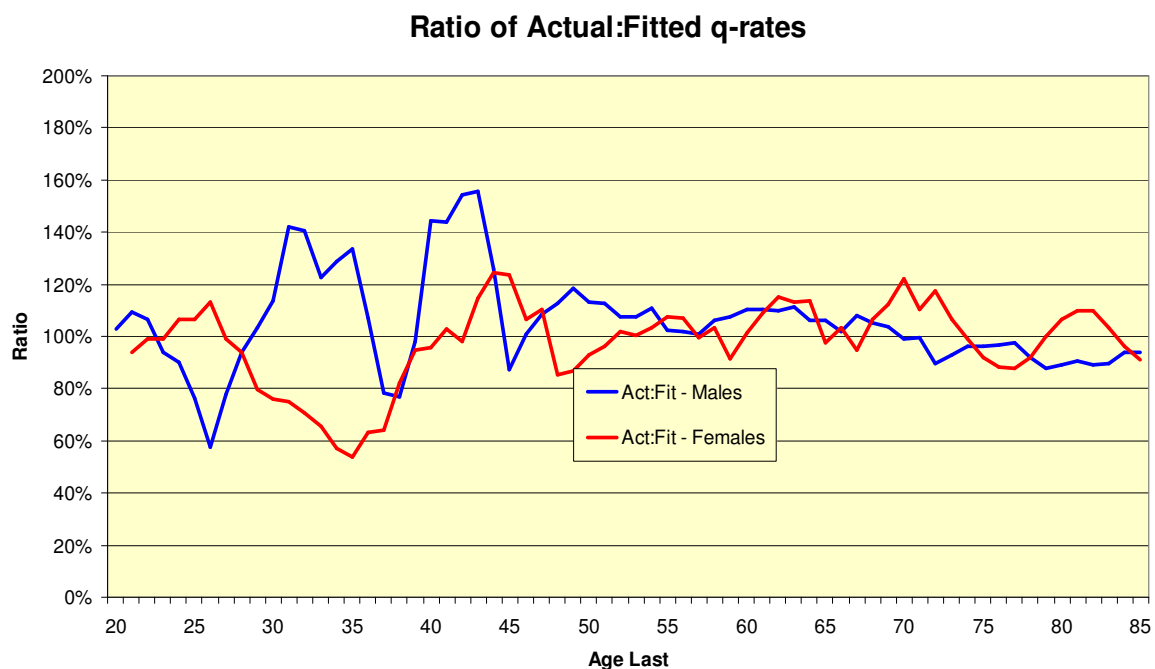
The exposed to risk, deaths, actual q-rates, and fitted q-rates are given in Appendix 5:

Traditional Policies

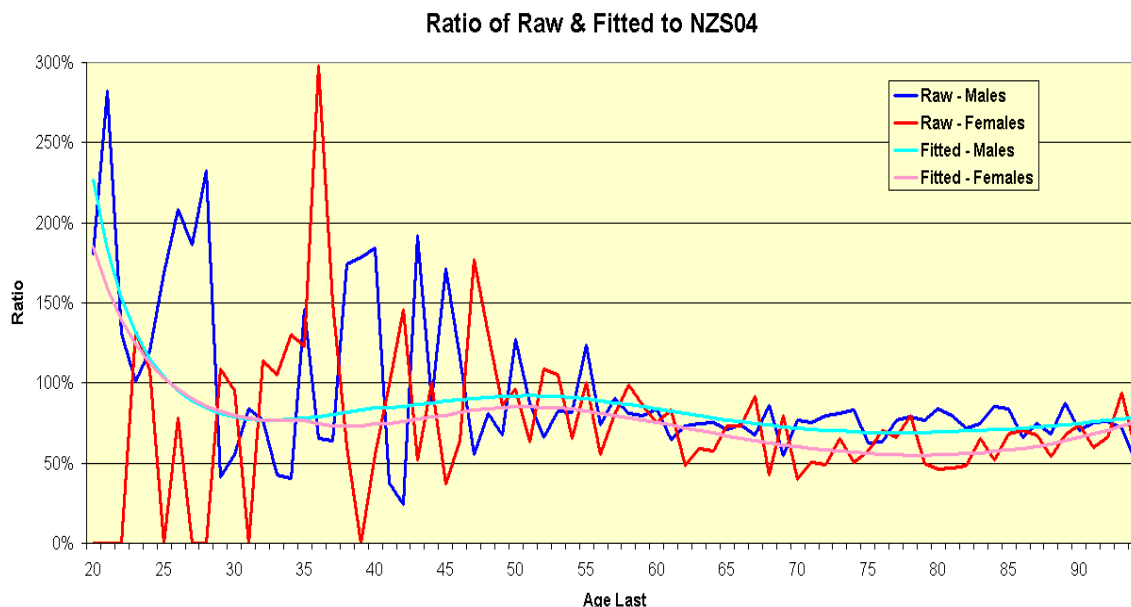
The following graph summarises the raw and fitted log q-rates:



The ratio of the fitted rates to the raw rates (smoothed by taking 5 age averages) is given below:



The following graph compares the raw and fitted curve against the graduated table produced in the last study. The shape of the curve is similar to last time; however, this time traditional policies for females have lower mortality. Also, there is some flexibility with regards the shape of the curve at the youngest ages.

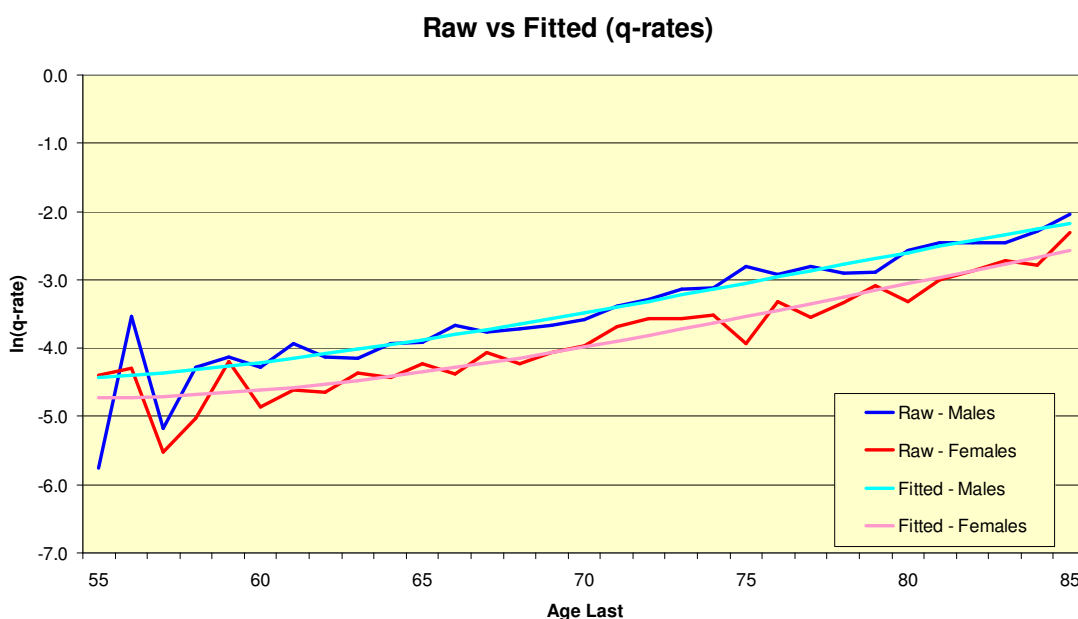


The exposed to risk, deaths, actual q-rates, and fitted q-rates are given in Appendix 5:

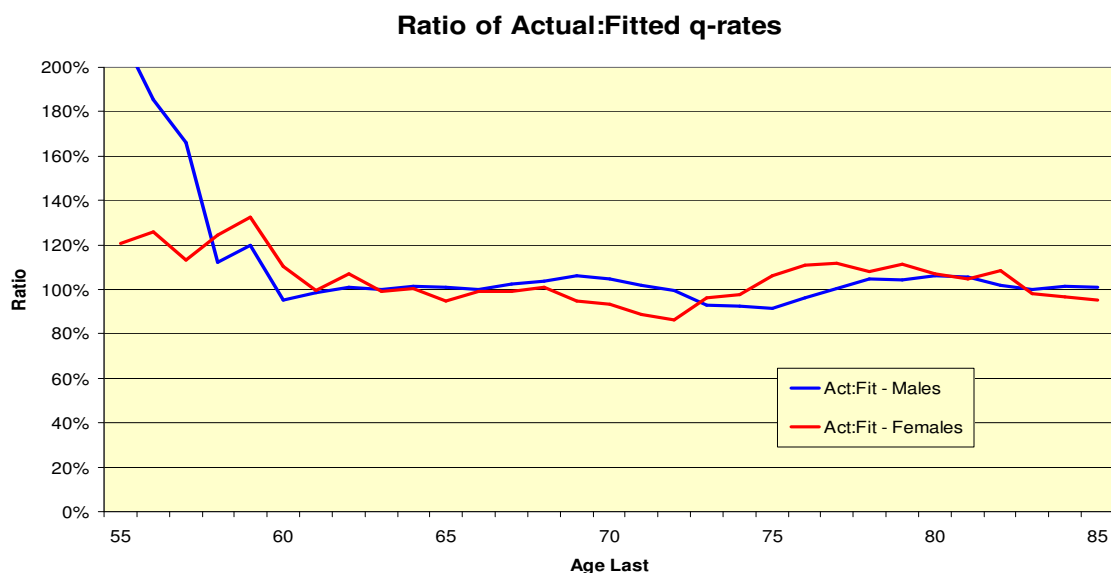
Direct Marketed Guaranteed Policies

These tend to be marketed to older people; for that reason we only consider ages from 55 as there are only sparse data below that age.

The following graph summarises the raw and fitted log q-rates:

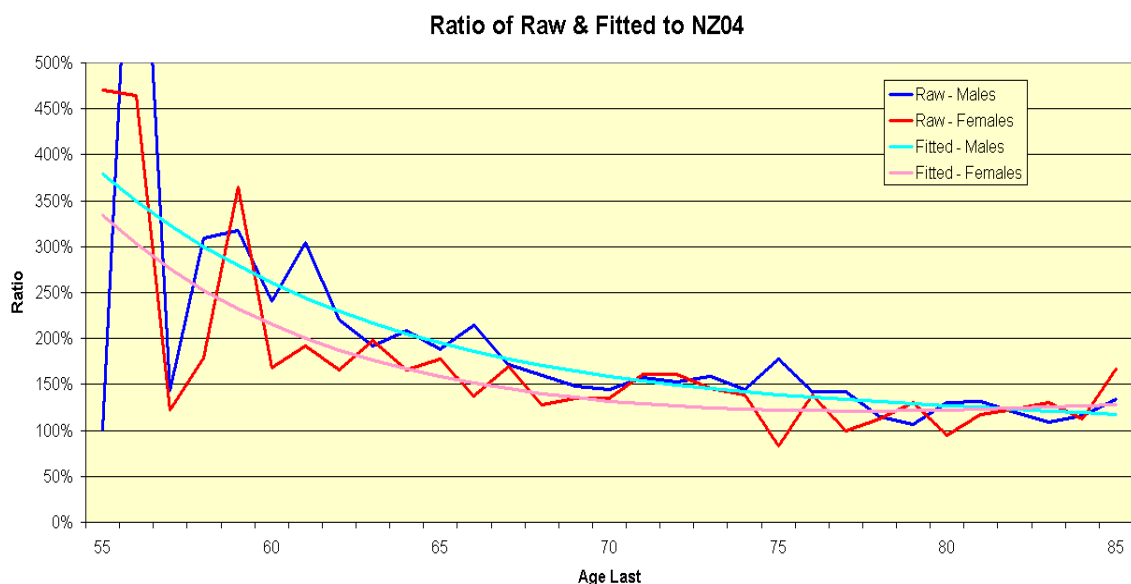


The ratio of the fitted rates to the raw rates (smoothed by taking 5 age averages) is given below:



Comparison With Other Tables

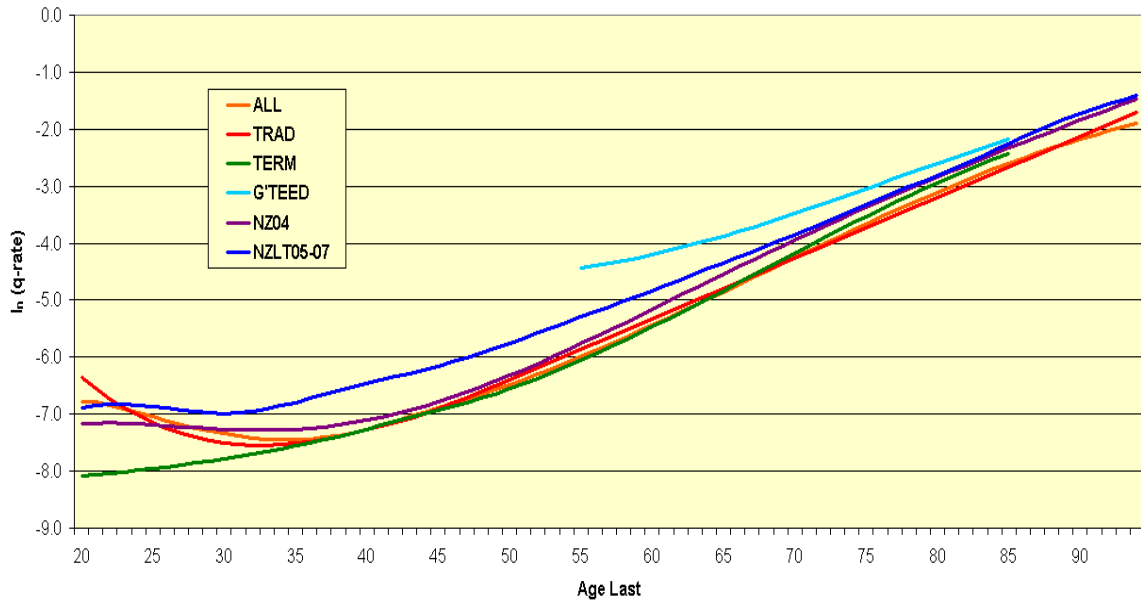
The following graph compares the raw and fitted curve against that produced in the last study. Note that the excess mortality declines by age but remains well above the 100% mark (they only approach 100% of NZ04 at about age 80 but again does not drop below).



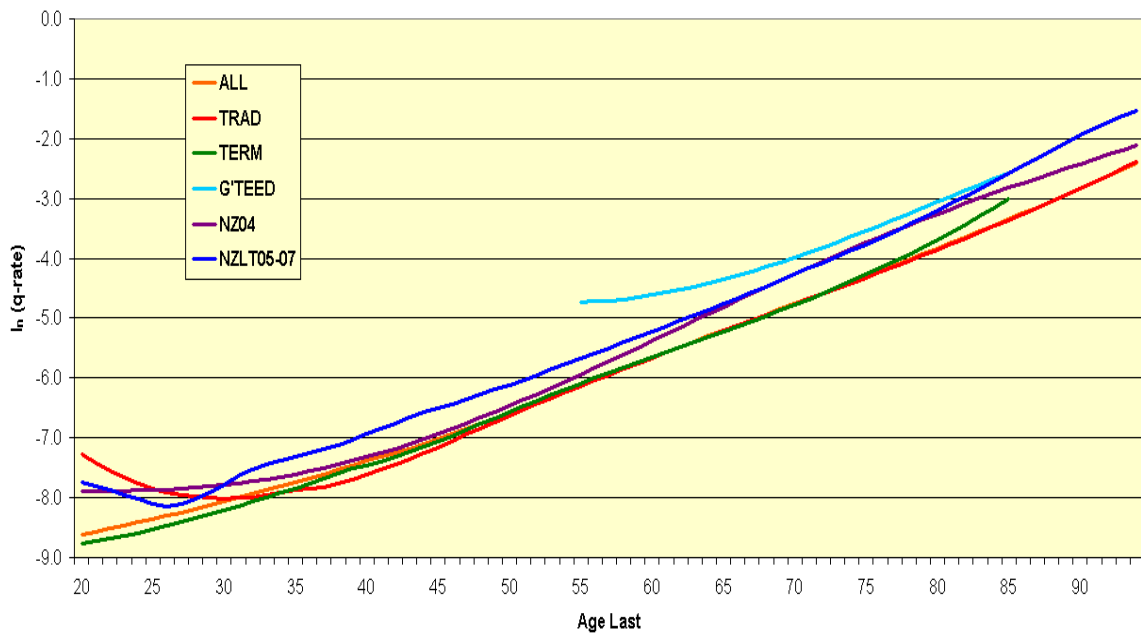
The exposed to risk, deaths, actual q-rates, and fitted q-rates are given in Appendix 5.

The following shows the comparison of the fitted q-rates against the previous study (NZ04) and the latest NZ Life Tables (NZLT05-07):

Comparison of Fitted q-rates - MALES

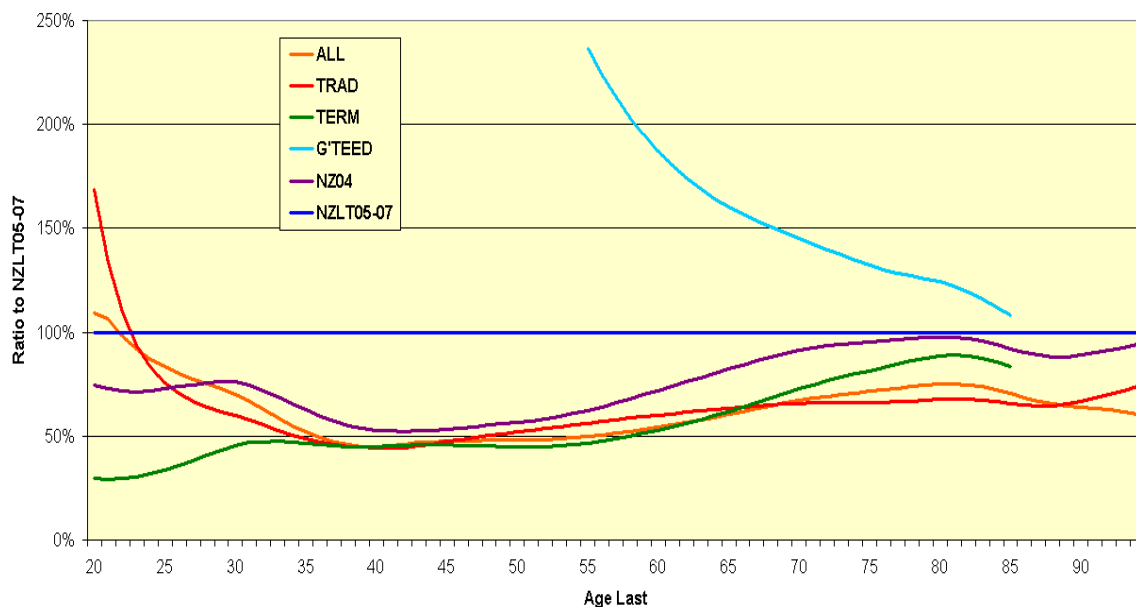


Comparison of Fitted q-rates - FEMALES

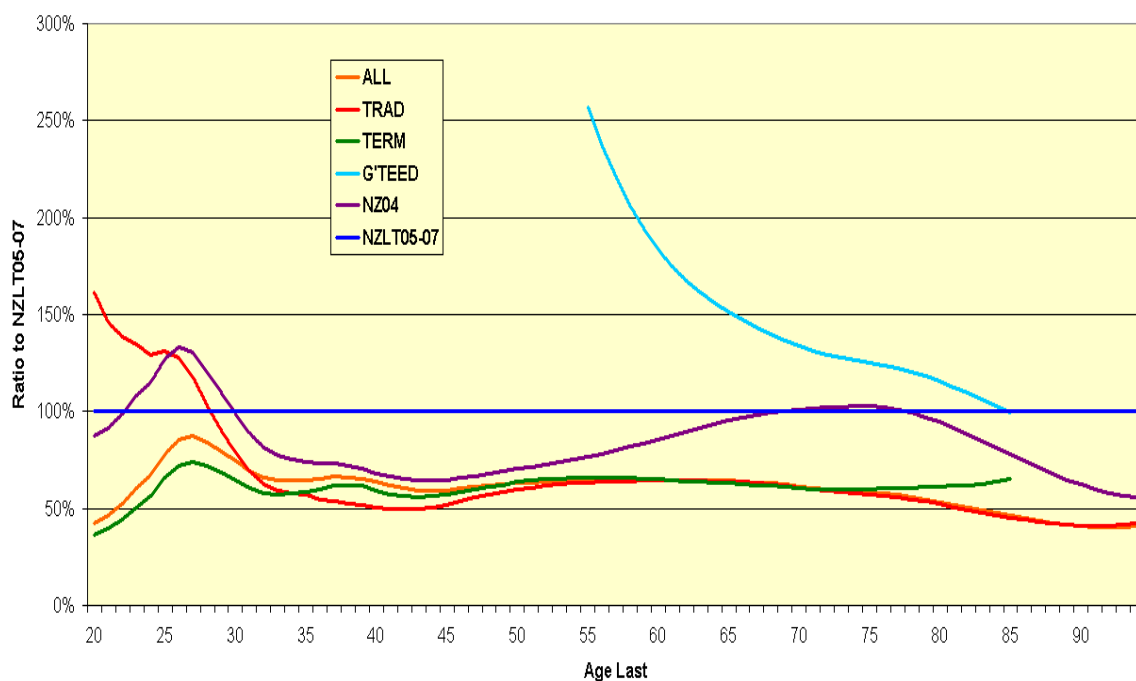


The ratio at each age of the fitted rates (and previous) against NZLT 05-07 are shown below:

Comparison of Fitted q-rates - MALES



Comparison of Fitted q-rates - FEMALES



7 Cause of Death Experience

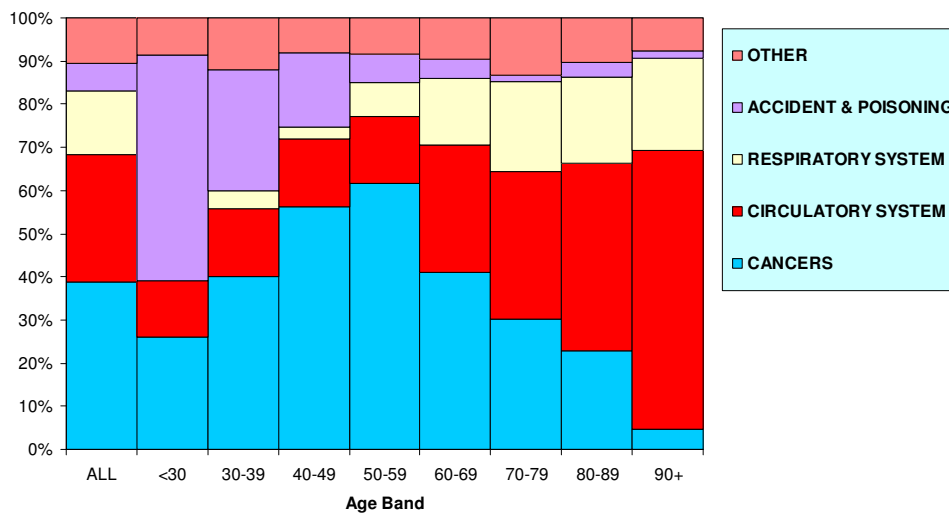
Of the 21,078 deaths over the last three years 11,761 (56%) had a valid cause of death noted.

Attached in Appendix 7 is the breakdown of these claims by type (separately for Males & Females) by age band.

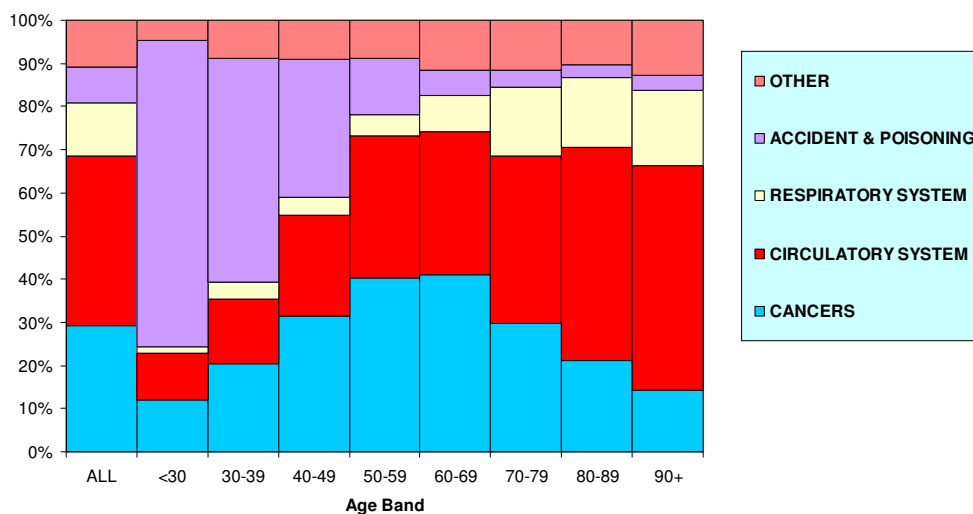
There is also a breakdown by Sex and Smoker Status (combined for all ages).

The changing proportion by age can be seen in the following graphs (where smaller categories have been combined into Other):

Cause of Death - Females



Cause of Death - Males



8 Mortality Improvement

For each year the q_x has been calculated as:

$$q_x = \frac{2d_x}{(N_x^0 + N_x^1 + d_x)}$$

where:

N_x^0	=	Number of In force at the Start of the Year
N_x^1	=	Number of In force at the End of the Year
d_x	=	Number of Deaths during the Year
x	=	Age at the Start of the Year

Note that by definition, the N_x^0 for year $(y+1)$ will be the same as the N_x^1 of the prior year (year y) except that all ages will differ by one year.

The reason for this approach was due to the available data. In many cases various life companies either ceased to contribute or were taken over by other entities. This meant that there was not a continuous series of data from the first year (in force at 31 December 1990) to the last (i.e. 31 December 2007). In order to use all of the data a year by year approach was taken.

The Traditional business and the combined Term business were investigated. Surprisingly, the results were markedly different between the two types of business.

Population Experience

As a point of reference, the annualised improvement for the NZ Life Tables (i.e. those issued by the Department of Statistics) since 1991 is about 3.0% for Males and 2.5% for Females. A more detailed age banded breakdown is given in Appendix 8.

Insured Lives Experience

The improvements for the NZSA companies is detailed in the table below (for ultimate policies only, being a policy duration of 4 or more). The calculations are based on the ratio of actual deaths compared to the expected number of deaths (where expected is the overall age based q -rate using NZLT 05-07).

Years	Term		Traditional	
	Ratio	Improvement Rate	Ratio	Improvement Rate
1993 - 1995	71%	N/A	111%	N/A
1996 - 1998	64%	3.3%	99%	3.8%
1999 - 2001	63%	2.1%	85%	4.4%
2002 - 2004	62%	1.6%	82%	3.3%
2005 - 2007	63%	0.9%	68%	4.0%

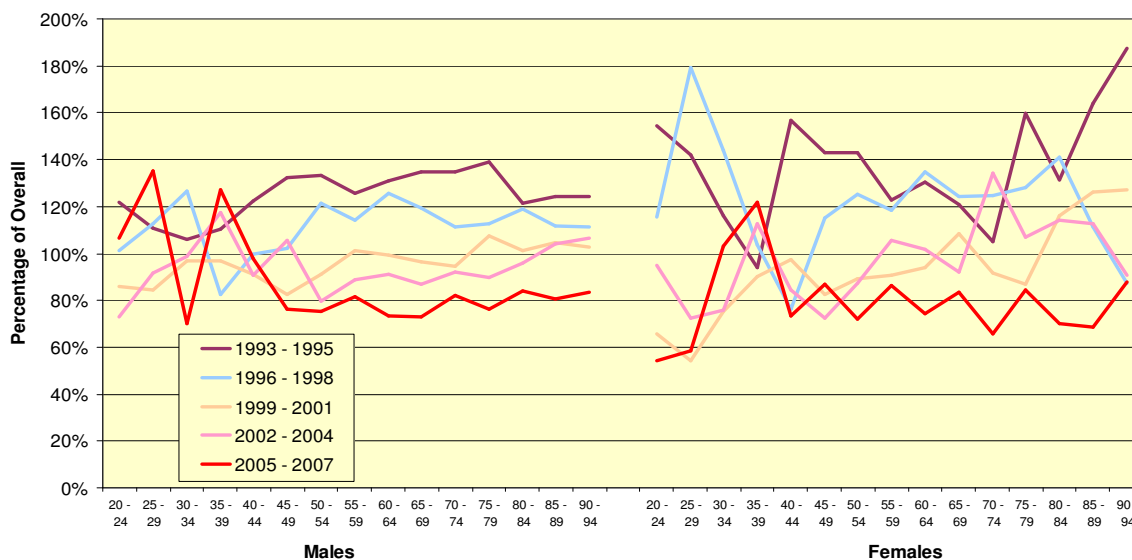
Note that the Improvement rate is the annualised percentage improvement from 1993-1995.

Interestingly, the mortality experience for Term has improved only modestly over the past 12 years. Conversely Traditional has seen a consistent 4% per annum improvement throughout the period.

The following two graphs show the ratio of each actual q-rate to the overall q-rate by age band over the past 15 years:

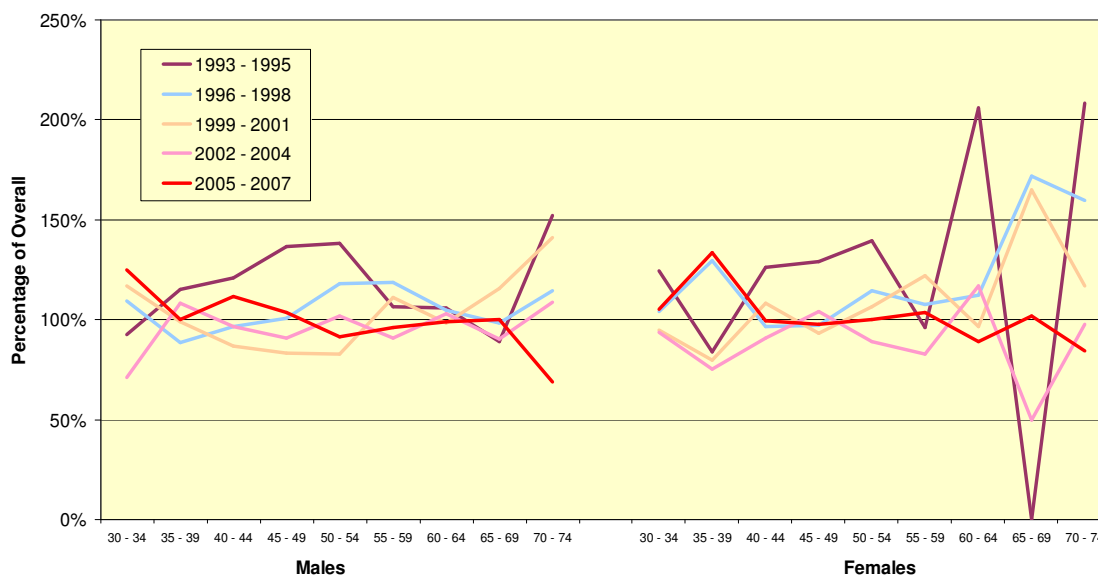
TRADITIONAL

Ratio of Mortality to Total



TERM

Ratio of Mortality to Total



Note also that the proportion of smokers in the Term data has remained constant within the 10% - 12% range so is not an explanation for the lack of improvement. It should be noted that almost all of these policies have had some underwriting.

From the graphs it is clear that the overall results also apply across the ages (noting that the youngest and oldest age bands had too few data for credible analysis). The rate of improvement tends to be more consistent at older ages where Traditional has a higher proportion of exposed to risk. This seems to have been the reason for the difference in the improvement rate shown above.

9 Select By Sum Assured

There were insufficient data for most product groups to analyse the select period with any level of confidence. Only the Term products combined as well as the Direct Marketing (Guaranteed Acceptance) had sufficient data.

The results indicate that the select period was around 1 year for males. The results for females indicated that some effects of selection still appeared after 3 years had elapsed. Full details are attached in Appendix 9.

These results should be taken with caution as they are aggregated across all ages. If the select period varies by age (e.g. as accidents predominate at younger ages and other causes at older ages) then the actual age mix will distort the picture somewhat.

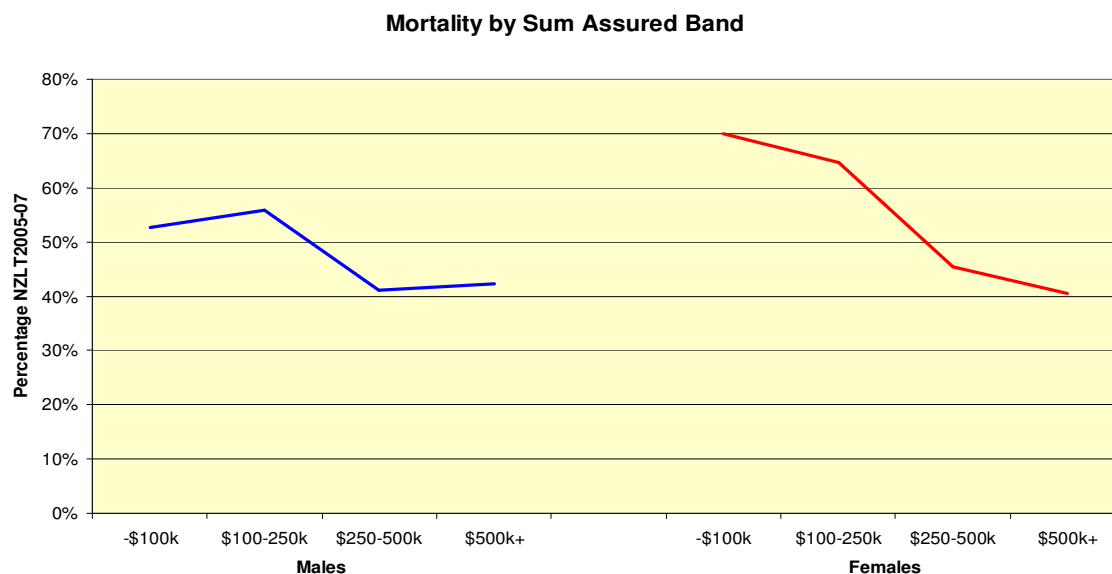
To investigate this, the Term results were split into age groups as shown below:

Sex	Age Band	Expected Deaths					Actual Deaths					Ratio Actual:Expected				
		0	1	2	3	Ult	0	1	2	3	Ult	0	1	2	3	Ult
Males	-39	120	106	87	71	214	58	43	25	34	111	48%	41%	29%	48%	52%
	40 - 49	130	134	134	129	821	50	74	57	51	374	39%	55%	43%	39%	46%
	50 - 59	138	148	157	162	1,497	48	75	74	79	743	35%	51%	47%	49%	50%
	60 +	64	77	93	106	1,058	22	37	48	64	637	34%	48%	52%	60%	60%
	All	451	465	471	468	3,589	178	229	204	228	1,865	39%	49%	43%	49%	52%
Females	-39	59	55	48	41	134	23	25	24	20	97	39%	46%	50%	49%	73%
	40 - 49	72	75	76	75	455	25	24	34	33	267	35%	32%	45%	44%	59%
	50 - 59	60	65	69	71	587	14	24	23	31	407	23%	37%	33%	43%	69%
	60 +	25	32	41	47	335	8	15	25	28	210	32%	47%	61%	60%	63%
	All	217	227	234	234	1,511	70	88	106	112	981	32%	39%	45%	48%	65%

The results for the females still showed a marked increase from duration 3 to ultimate. For males, the one year select period remained except for the 60+ age band where the select period appeared longer.

These results are not dissimilar to those obtained in the previous study.

The variation of the mortality by size of sum assured (for term products, defined as previously) is shown in the graph below:



There is a clear trend in terms of size with a higher rate of mortality for policies under \$250,000 compared to those larger than that amount. The detail, split by duration is shown in the table below. Overall there were just 21 claims for \$1 million or more. For privacy reasons no split was done at this level.

Type	Sex	Expected Deaths					Actual Deaths					Ratio Actual:Expected				
		0	1	2	3	Ult	0	1	2	3	Ult	0	1	2	3	Ult
TERM	M	451	465	471	468	3,589	178	229	204	228	1,865	39%	49%	43%	49%	52%
	F	217	227	234	234	1,511	70	88	106	112	981	32%	39%	45%	48%	65%
Type	Sex	Expected Deaths					Actual Deaths					Ratio Actual:Expected				
Type	Sex	0	1	2	3	Ult	0	1	2	3	Ult	0	1	2	3	Ult
Males	-\$100k	131	141	157	166	1,908	69	87	96	103	1,005	53%	62%	61%	62%	53%
	\$100-250k	154	164	167	166	1,131	57	84	61	84	632	37%	51%	37%	51%	56%
	\$250-500k	111	108	100	93	402	37	36	38	31	165	33%	33%	38%	33%	41%
	\$500k+	56	52	47	43	149	15	22	9	10	63	27%	42%	19%	23%	42%
Females	-\$100k	76	83	94	99	779	26	52	50	58	545	34%	62%	53%	59%	70%
	\$100-250k	77	82	84	85	547	27	27	42	37	354	35%	33%	50%	44%	65%
	\$250-500k	49	47	44	40	154	15	8	12	14	70	31%	17%	27%	35%	45%
	\$500k+	16	14	12	10	30	2	1	2	3	12	13%	7%	16%	29%	40%

Note: Expected is against NZLT 05-07

Appendix 1 – Classes of Policy

Classification	Description
1 Traditional	Level premium “lifetime” benefits with guaranteed premiums. Includes all traditional whole of life and endowment type policies where the premium is guaranteed, level (or could decrease) for the entire term of the policy. The term is generally greater than 10 years.
2 Unbundled	Death benefits provided under unbundled contracts, where the death benefit is not a standalone benefit, but comprises part of the main benefit of the contract along side the investment part of the contract. The unbundled benefit may be either capital guaranteed or investment-linked, but must carry significant death risk (ie cover of at least \$2,000).
3 Level Temporary - Regular Premium	Temporary insurances where premiums are either <ul style="list-style-type: none"> • fully guaranteed until age 80 or older, or for a minimum term of ten years, or • where the intention is for premiums to remain level throughout the premium term (but may be reviewed subject to significant changes in portfolio mortality) The sums insured may be increasing (including CPI indexed), level or reducing.
4 Mortgage Repayment Insurance	Single Premium term business (predominantly Mortgage Repayment Insurance).
5 Other Term Policies	These policies will have some form of underwriting. The premium rates can be reviewed and generally increase with age (typically every year, but may have a level period not exceeding 10 years).
6 Direct Marketing - Guaranteed Acceptance	Benefits that have been sold by distribution methods that involves direct contact with the end consumer. eg. direct mail, or magazine inserts etc. No verbal insurance advice is provided with these contracts. These benefits have been sold on a guaranteed acceptance basis with no underwriting. Products also written by advisors are not included.
7 Direct Marketing Other	All other direct marketed benefits that aren’t guaranteed acceptance and have involved some underwriting.

Appendix 2 – Underwriting Codes Used

Name	Description
0 Minimum Evidence	Lives where only a few questions were asked on the proposal form (for example, abridged personal statement).
1 Non-Medical	Lives were not medically examined or para-medically examined but other satisfactory evidence of health, which may or may not have included a report from an attending doctor, was provided.
2 Medical	Lives were medically examined at entry whether or not medical reports or para-medical examinations were available.
3 Para-Medical	Lives underwent a para-medical examination at entry whether or not a report from an attending doctor was produced.
G Group Continuation	Benefits were effected under a group policy continuation option.
I Guaranteed Insurability	Benefits were effected under a guaranteed insurability option.
C Conversion	Benefits were effected by a conversion of another policy.
U Unknown	Benefits were underwritten, but the underwriting basis is unknown.
D Direct Marketing Guaranteed Acceptance	Benefits underwritten under benefit classifications 05.
O Direct Marketing Other	Benefits underwritten under benefit classifications 06.
N None	Policies were not underwritten.

Appendix 3 – Derivation Of q_x

The standard formulae for calculating the q_x by a census method are (refer Section 4 – Methodology):

$$m_x = \frac{2d_x}{(N_x^0 + N_x^1)} \quad (1)$$

and $q_x = \frac{m_x}{\left(1 + \frac{m_x}{2}\right)} \quad (2)$

The original definition of Exposed to Risk can be stated as:

Number of Policies in force for the Whole Year;
plus $\frac{1}{2}$ years exposure for Deaths during the Year;
plus $\frac{1}{2}$ years exposure for Other Exits during the Year;
plus $\frac{1}{2}$ years exposure for Deaths during the Year.

The sum of the first three categories equal twice the average number in force over the year

$$q_x = \frac{2d_x}{(N_x^0 + N_x^1 + d_x)} \quad (3)$$

This is equivalent to the definitions in (1) and (2) above.

Inserting equation (1) into equation (2) gives:

$$\begin{aligned} q_x &= \left(\frac{2d_x}{(N_x^0 + N_x^1)} \right) \div \left(1 + \frac{d_x}{(N_x^0 + N_x^1)} \right) \\ &= \left(\frac{2d_x}{(N_x^0 + N_x^1)} \right) \div \left(\frac{(N_x^0 + N_x^1 + d_x)}{(N_x^0 + N_x^1)} \right) \\ &= \frac{2d_x}{(N_x^0 + N_x^1 + d_x)} \end{aligned}$$

Appendix 4 – Summary By Number of Policies

Male

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
AGGREGATE Exposure	899,857	3,116	31,473	66,102	26,750	480	7,675
Expected	13,127	12	130	230	94	11	37
Actual	8,741	0	82	70	65	14	26
A/E	67%	0%	63%	30%	69%	124%	70%
NON-SMOKER Exposure	57,003	17,488	141,539	104,532	1,135,499	62,961	50,352
Expected	741	71	559	350	3,518	1,590	292
Actual	554	29	215	78	1,666	2,118	215
A/E	75%	41%	38%	22%	47%	133%	74%
SMOKER Exposure	9,289	7,018	11,955	10,485	194,865	16,877	8,782
Expected	206	33	52	29	482	437	26
Actual	230	23	56	16	456	650	37
A/E	112%	69%	107%	55%	95%	149%	141%
TOTAL Exposure	966,149	27,621	184,967	181,118	1,357,113	80,317	66,809
Expected	14,074	116	742	609	4,094	2,038	355
Actual	9,525	52	353	164	2,187	2,782	278
A/E	68%	45%	48%	27%	53%	136%	78%

Expected: NZLT 05-07.

Female

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
AGGREGATE Exposure	338,396	1,736	23,799	20,903	18,996	756	4,359
Expected	2,189	4	50	40	39	11	12
Actual	1,157	0	32	18	34	15	14
A/E	53%	0%	64%	45%	88%	139%	121%
NON-SMOKER Exposure	28,186	10,389	123,019	51,703	983,772	91,617	68,688
Expected	183	23	301	93	1,621	1,552	250
Actual	102	14	145	25	782	1,880	184
A/E	56%	62%	48%	27%	48%	121%	73%
SMOKER Exposure	5,498	3,866	9,047	6,999	173,666	23,369	13,291
Expected	101	11	23	10	244	404	25
Actual	101	5	44	1	276	548	36
A/E	100%	44%	190%	10%	113%	136%	147%
TOTAL Exposure	372,080	15,991	155,864	79,604	1,176,434	115,741	86,337
Expected	2,474	38	375	143	1,904	1,967	286
Actual	1,360	19	221	44	1,092	2,443	234
A/E	55%	50%	59%	31%	57%	124%	82%

Expected: NZLT 05-07

Appendix 5 – Actual vs Expected

A/E By Numbers

Male

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
Under 20	44%	0%	96%	221%	95%	0%	425%
20 - 29	112%	0%	63%	62%	47%	0%	36%
30 - 39	60%	19%	15%	55%	46%	248%	40%
40 - 49	53%	27%	40%	25%	49%	87%	71%
50 - 59	55%	55%	51%	28%	52%	220%	77%
60 - 69	59%	49%	55%	20%	62%	157%	58%
70 - 79	72%	52%	42%	0%	76%	134%	93%
80 - 89	75%	28%	51%	0%	165%	119%	94%
90 - 99	64%	0%			0%	52%	78%
ALL AGES	68%	45%	48%	27%	53%	136%	78%

Female

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
Under 20	95%	401%	0%	737%	161%	53691%	0%
20 - 29	51%	521%	0%	66%	51%	0%	77%
30 - 39	84%	0%	40%	20%	60%	259%	67%
40 - 49	64%	60%	53%	26%	53%	150%	62%
50 - 59	65%	60%	82%	35%	56%	192%	67%
60 - 69	64%	37%	59%	24%	64%	140%	100%
70 - 79	60%	0%	44%	65%	82%	128%	100%
80 - 89	47%	0%	43%	0%	109%	104%	98%
90 - 99	39%	0%			0%	50%	40%
ALL AGES	55%	50%	59%	31%	57%	124%	82%

Expected: NZLT 05-07.

A/E By Sum Assured

Male

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
Aggregate	62%	0%	50%	32%	96%	118%	67%
Non-Smoker	58%	37%	26%	19%	42%	131%	53%
Smoker	61%	72%	88%	47%	71%	148%	107%
TOTAL	61%	40%	31%	23%	44%	134%	58%
Under 20	30%	0%	62%	42%	23%	0%	106%
20 - 29	88%	0%	75%	20%	34%	0%	2%
30 - 39	47%	13%	10%	17%	33%	18%	38%
40 - 49	58%	6%	23%	17%	47%	40%	75%
50 - 59	50%	78%	33%	31%	44%	191%	68%
60 - 69	55%	35%	48%	15%	51%	158%	45%
70 - 79	72%	15%	13%	0%	75%	123%	40%
80 - 89	76%	8%	45%	0%	370%	116%	25%
90 - 99	69%	0%			0%	52%	6%
ALL AGES	61%	40%	31%	23%	44%	134%	58%
Exposure	15,472m	2,013m	23,856m	8,232m	312,992m	513m	6,242m
Expected	96m	7m	63m	24m	801m	8m	17m
Actual	59m	3m	19m	5m	356m	11m	10m

Female

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
Aggregate	61%	0%	54%	50%	89%	262%	110%
Non-Smoker	47%	75%	24%	16%	39%	123%	45%
Smoker	78%	80%	246%	9%	99%	142%	88%
TOTAL	60%	70%	38%	19%	45%	127%	51%
Under 20	23%	431%	0%	205%	81%	0%	0%
20 - 29	83%	476%	0%	7%	39%	0%	31%
30 - 39	79%	0%	34%	4%	44%	18%	68%
40 - 49	59%	71%	27%	20%	40%	38%	54%
50 - 59	69%	58%	54%	24%	52%	183%	62%
60 - 69	47%	119%	44%	19%	51%	143%	37%
70 - 79	56%	0%	47%	70%	40%	123%	20%
80 - 89	56%	0%	54%	0%	365%	109%	18%
90 - 99	53%	0%			0%	38%	2%
ALL AGES	60%	70%	38%	19%	45%	127%	51%
Exposure	6,763m	1,135m	18,212m	4,491m	233,327m	781m	9,474m
Expected	18m	2m	25m	6m	301m	8m	16m
Actual	11m	1m	9m	1m	136m	10m	8m

Expected: NZLT 05-07.

A/E Loaded Policies

An analysis of the loaded policies was performed. Note that the number of policies with a loading was relatively small. For the purpose of this exercise, the expected q-rate was calculated for each policy as the standard age based q-rate increased by the recorded loading. Approximately two thirds of the loadings were for 100% or less with less than 10% of loadings being for more than 200%.

In addition to this analysis, a comparison was made of the overall results with and without the loaded policies being included. No material difference was found so the loaded policies were included (with appropriate adjustments made for those policies with the largest loadings). This also means that any misclassification of loading in the claims file (compared to the corresponding policy in the in-force files) would not distort the results.

Male

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
Under 20	0%	0%	0%	0%	0%		0%
20 - 29	152%	0%	0%	0%	26%		0%
30 - 39	0%	0%	21%	0%	28%		0%
40 - 49	35%	0%	0%	30%	36%		0%
50 - 59	46%	66%	23%	0%	44%		465%
60 - 69	66%	52%	18%	0%	42%		0%
70 - 79	79%	0%	0%	0%	56%		0%
80 - 89	67%				167%		
90 - 99	75%						
ALL AGES	67%	44%	16%	8%	41%		163%
UNLOADED	68%	45%	48%	27%	53%	136%	78%
Adjusted Exposure	20,158	1,559	16,501	4,017	165,921	0	1,234
Expected	240	7	58	13	564	0	4
Actual	160	3	9	1	231	0	6

Female

Category	Trad	Unbund	Lev Term	MRI	YRT	G'tee Acc	Direct Oth
Under 20	0%	0%	0%	0%	0%		0%
20 - 29	0%	0%	0%	0%	0%		0%
30 - 39	102%	0%	0%	0%	41%		0%
40 - 49	23%	0%	0%	0%	40%		314%
50 - 59	83%	109%	35%	0%	28%		0%
60 - 69	94%	0%	12%	0%	37%		0%
70 - 79	30%	0%	36%	0%	74%		
80 - 89	39%		0%		195%		
90 - 99	209%						
ALL AGES	62%	44%	18%	0%	37%		89%
UNLOADED	55%	50%	59%	31%	57%	124%	82%
Adjusted Exposure	12,322	981	16,389	3,375	150,450	0	1,845
Expected	82	2	34	6	275	0	3
Actual	51	1	6	0	101	0	3

Appendix 6 – Cause Of Death

Male

Disease Type	ALL	<30	30-39	40-49	50-59	60-69	70-79	80-89	90+
Infectious and parasitic	63	0	2	8	3	11	17	17	5
Neoplasms	2,564	8	41	158	497	596	653	521	90
Endocrine, nutritional, metabolic and immunity disorders	57	0	3	2	10	15	20	4	3
Blood and blood forming organs	50	0	0	0	6	9	24	9	2
Mental disorders	154	1	3	2	2	18	22	76	30
Nervous system and sense organs	98	0	1	10	18	22	23	23	1
Circulatory system	3,443	7	30	118	405	482	854	1,221	326
Respiratory system	1,073	1	8	21	61	120	351	401	110
Digestive system	129	1	0	2	20	21	47	27	11
Genito-urinary system	241	0	0	5	8	39	75	87	27
Musculoskeletal & connective tissue	5	0	0	0	4	0	1	0	0
Congenital anomalies	1	0	0	0	0	0	0	0	1
Symptoms, signs and ill-defined conditions	307	14	11	33	53	54	61	62	19
External causes of injury and poisoning	425	33	93	127	105	31	22	12	2
Unknown	1	0	0	0	0	1	0	0	0
Specified as other	138	1	9	17	39	32	27	12	1
Grand total	8,749	66	201	503	1,231	1,451	2,197	2,472	628
Unspecified	6,805	46	95	380	939	1,207	1,867	1,941	330

Female

Disease Type	ALL	<30	30-39	40-49	50-59	60-69	70-79	80-89	90+
Infectious and parasitic	21	0	0	1	1	4	7	6	2
Neoplasms	1,172	6	56	165	318	249	254	121	3
Endocrine, nutritional and metabolic and immunity disorders	45	0	2	7	2	7	19	8	0
Blood and blood forming organs	16	0	0	0	7	2	5	2	0
Mental disorders	16	0	2	0	0	2	9	3	0
Nervous system and sense organs	30	0	6	4	4	4	7	4	1
Circulatory system	888	3	22	46	80	179	287	229	42
Respiratory system	444	0	6	8	41	93	176	106	14
Digestive system	61	0	0	3	3	15	24	15	1
Genito-urinary system	87	1	2	2	7	19	38	17	1
Musculoskeletal & connective tissue	3	0	0	0	1	1	1	0	0
Congenital anomalies	1	0	0	0	1	0	0	0	0
Symptoms, signs and ill-defined	64	4	10	9	11	12	6	11	1
External causes of injury and poisoning	128	8	29	41	23	15	6	6	0
Unknown	0	0	0	0	0	0	0	0	0
Specified as other	36	1	5	7	17	4	2	0	0
Grand Total	3,012	23	140	293	516	606	841	528	65
Unspecified	2,512	12	73	235	438	435	674	580	65

Cause Of Death - Percentages

Male

	ALL	<30	30-39	40-49	50-59	60-69	70-79	80-89	90+
Infectious and parasitic diseases	0.7%	0.0%	1.0%	1.6%	0.2%	0.8%	0.8%	0.7%	0.8%
Neoplasms	29.3%	12.1%	20.4%	31.4%	40.4%	41.1%	29.7%	21.1%	14.3%
Endocrine, nutritional metabolic diseases and immunity disorders	0.7%	0.0%	1.5%	0.4%	0.8%	1.0%	0.9%	0.2%	0.5%
Blood and blood forming organs	0.6%	0.0%	0.0%	0.0%	0.5%	0.6%	1.1%	0.4%	0.3%
Mental disorders	1.8%	1.5%	1.5%	0.4%	0.2%	1.2%	1.0%	3.1%	4.8%
Nervous system & sense organs	1.1%	0.0%	0.5%	2.0%	1.5%	1.5%	1.0%	0.9%	0.2%
Circulatory system	39.4%	10.6%	14.9%	23.5%	32.9%	33.2%	38.9%	49.4%	51.9%
Respiratory system	12.3%	1.5%	4.0%	4.2%	5.0%	8.3%	16.0%	16.2%	17.5%
Digestive system	1.5%	1.5%	0.0%	0.4%	1.6%	1.4%	2.1%	1.1%	1.8%
Genito-urinary system	2.8%	0.0%	0.0%	1.0%	0.6%	2.7%	3.4%	3.5%	4.3%
Musculoskeletal & connective tissue	0.1%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%
Congenital anomalies	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Symptoms, signs and ill-defined	3.5%	21.2%	5.5%	6.6%	4.3%	3.7%	2.8%	2.5%	3.0%
External causes and poisoning	4.9%	50.0%	46.3%	25.2%	8.5%	2.1%	1.0%	0.5%	0.3%
Unknown	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Specified as other	1.6%	1.5%	4.5%	3.4%	3.2%	2.2%	1.2%	0.5%	0.2%
Grand total	100.0%	0.7%	1.9%	5.7%	14.0%	17.1%	26.1%	28.4%	6.2%
Unspecified (% total deaths)	43.8%	41.1%	32.1%	43.0%	43.3%	45.4%	45.9%	44.0%	34.4%

Female

	All	<30	30-39	40-49	50-59	60-69	70-79	80-89	90+
Infectious and parasitic diseases	0.7%	0.0%	0.0%	0.3%	0.2%	0.7%	0.8%	1.1%	3.1%
Neoplasms	38.9%	26.1%	40.0%	56.3%	61.6%	41.1%	30.2%	22.9%	4.6%
Endocrine, nutritional metabolic diseases and immunity disorders	1.5%	0.0%	1.4%	2.4%	0.4%	1.2%	2.3%	1.5%	0.0%
Blood and blood forming organs	0.5%	0.0%	0.0%	0.0%	1.4%	0.3%	0.6%	0.4%	0.0%
Mental disorders	0.5%	0.0%	1.4%	0.0%	0.0%	0.3%	1.1%	0.6%	0.0%
Nervous system and sense organs	1.0%	0.0%	4.3%	1.4%	0.8%	0.7%	0.8%	0.8%	1.5%
Circulatory system	29.5%	13.0%	15.7%	15.7%	15.5%	29.5%	34.1%	43.4%	64.6%
Respiratory system	14.7%	0.0%	4.3%	2.7%	7.9%	15.3%	20.9%	20.1%	21.5%
Digestive system	2.0%	0.0%	0.0%	1.0%	0.6%	2.5%	2.9%	2.8%	1.5%
Genito-urinary system	2.9%	4.3%	1.4%	0.7%	1.4%	3.1%	4.5%	3.2%	1.5%
Musculoskeletal and connective tissue	0.1%	0.0%	0.0%	0.0%	0.2%	0.2%	0.1%	0.0%	0.0%
Congenital anomalies	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
Symptoms, signs and ill-defined	2.1%	17.4%	7.1%	3.1%	2.1%	2.0%	0.7%	2.1%	1.5%
External causes of injury and poisoning	4.2%	34.8%	20.7%	14.0%	4.5%	2.5%	0.7%	1.1%	0.0%
Unknown	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Specified as other	1.2%	4.3%	3.6%	2.4%	3.3%	0.7%	0.2%	0.0%	0.0%
Grand total	100.0%	0.6%	3.9%	9.6%	17.3%	18.8%	27.4%	20.1%	2.4%
Unspecified (% total deaths)	45.5%	34.3%	34.3%	44.5%	45.9%	41.8%	44.5%	52.3%	50.0%

Cause Of Death - Sex And Smoker/ Non-Smoker - Number

Sex	All	M	F	All	All	All	M	M	M	F	F	F
Smoking Status	All	All	All	A	N	S	A	N	S	A	N	S
Infectious And Parasitic S	84	63	21	53	24	7	46	11	6	7	13	1
Neoplasms	3,736	2,564	1,172	1,828	1,509	399	1,552	816	196	276	693	203
Endocrine, Nutritional And Metabolic And Immunity Disorders	102	57	45	19	75	8	18	36	3	1	39	5
Blood And Blood Forming Organs	66	50	16	28	35	3	26	22	2	2	13	1
Mental Disorders	170	154	16	147	21	2	138	14	2	9	7	
Nervous System And Sense Organs	128	98	30	74	44	10	63	28	7	11	16	3
Circulatory System	4,331	3,443	888	2,583	1,443	305	2,345	894	204	238	549	101
Respiratory System	1,517	1,073	444	768	620	129	693	307	73	75	313	56
Digestive System	190	129	61	83	87	20	77	47	5	6	40	15
Genito-Urinary System	328	241	87	205	109	14	189	46	6	16	63	8
Musculoskeletal System And Connective Tissue	8	5	3	4	4		4	1			3	
Congenital Anomalies	2	1	1	2			1			1		
Symptoms, Signs And Ill- Defined Conditions	371	307	64	306	49	16	261	35	11	45	14	5
External Injury And Poisoning	553	425	128	112	331	110	99	253	73	13	78	37
Unspecified	9,317	6,805	2,512	3,954	3,887	1,476	3,399	2,512	894	555	1,375	582
Unknown	1	1		1			1					
Specified As Other	174	138	36	101	60	13	86	43	9	15	17	4
All Causes Combined	21,078	15,554	5,524	10,268	8,298	2,512	8,998	5,065	1,491	1,270	3,233	1,021

Smoking Status
Sex

A = Aggregate
M = Male

S = Smoker
F = Female

N = Non-smoker

Cause Of Death - Sex And Smoker/ Non-Smoker - Percentages

Sex	All	M	F	All	All	All	M	M	M	F	F	F
Smoking Status	All	All	All	A	N	S	A	N	S	A	N	S
All Causes Combined	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Infectious And Parasitic	0.4%	0.4%	0.4%	0.5%	0.3%	0.3%	0.5%	0.2%	0.4%	0.6%	0.4%	0.1%
Neoplasms	17.7%	16.5%	21.2%	17.8%	18.2%	15.9%	17.2%	16.1%	13.1%	21.7%	21.4%	19.9%
Endocrine, Nutritional And Metabolic And Immunity Disorders	0.5%	0.4%	0.8%	0.2%	0.9%	0.3%	0.2%	0.7%	0.2%	0.1%	1.2%	0.5%
Blood And Blood Forming Organs	0.3%	0.3%	0.3%	0.3%	0.4%	0.1%	0.3%	0.4%	0.1%	0.2%	0.4%	0.1%
Mental Disorders	0.8%	1.0%	0.3%	1.4%	0.3%	0.1%	1.5%	0.3%	0.1%	0.7%	0.2%	
Nervous System And Sense Organs	0.6%	0.6%	0.5%	0.7%	0.5%	0.4%	0.7%	0.6%	0.5%	0.9%	0.5%	0.3%
Circulatory System	20.5%	22.1%	16.1%	25.2%	17.4%	12.1%	26.1%	17.7%	13.7%	18.7%	17.0%	9.9%
Respiratory System	7.2%	6.9%	8.0%	7.5%	7.5%	5.1%	7.7%	6.1%	4.9%	5.9%	9.7%	5.5%
Digestive System	0.9%	0.8%	1.1%	0.8%	1.0%	0.8%	0.9%	0.9%	0.3%	0.5%	1.2%	1.5%
Genito-Urinary System	1.6%	1.5%	1.6%	2.0%	1.3%	0.6%	2.1%	0.9%	0.4%	1.3%	1.9%	0.8%
Musculoskeletal System And Connective Tissue			0.1%								0.1%	
Congenital Anomalies										0.1%		
Symptoms, Signs And Ill-Defined Conditions	1.8%	2.0%	1.2%	3.0%	0.6%	0.6%	2.9%	0.7%	0.7%	3.5%	0.4%	0.5%
External Injury And Poisoning	2.6%	2.7%	2.3%	1.1%	4.0%	4.4%	1.1%	5.0%	4.9%	1.0%	2.4%	3.6%
Unspecified	44.2%	43.8%	45.5%	38.5%	46.8%	58.8%	37.8%	49.6%	60.0%	43.7%	42.5%	57.0%
Unknown												
Specified As Other	0.8%	0.9%	0.7%	1.0%	0.7%	0.5%	1.0%	0.8%	0.6%	1.2%	0.5%	0.4%

Smoking Status
Sex

A = Aggregate
M = Male

S = Smoker
F = Female

N = Non-smoker

Appendix 7 – NZ Life Tables Improvement

The annualised improvement for the NZ Life Tables was found to be:

Male

Age Band	Mid Point q-rate				Improvement from 1990-92		
	1990-92	1995-97	2000-02	2005-07	1995-97	2000-02	2005-07
20 – 24	0.00192	0.00137	0.00108	0.00095	6.5%	5.6%	4.6%
25 – 29	0.00141	0.00120	0.00109	0.00078	3.2%	2.5%	3.9%
30 – 34	0.00133	0.00110	0.00106	0.00083	3.7%	2.2%	3.1%
35 – 39	0.00164	0.00118	0.00121	0.00103	6.4%	3.0%	3.1%
40 – 44	0.00196	0.00158	0.00155	0.00139	4.2%	2.3%	2.3%
45 – 49	0.00328	0.00255	0.00220	0.00206	4.9%	3.9%	3.1%
50 – 54	0.00559	0.00440	0.00352	0.00323	4.7%	4.5%	3.6%
55 – 59	0.00953	0.00761	0.00594	0.00520	4.4%	4.6%	4.0%
60 – 64	0.01593	0.01301	0.01026	0.00853	4.0%	4.3%	4.1%
65 – 69	0.02668	0.02230	0.01806	0.01434	3.5%	3.8%	4.1%
70 – 74	0.04279	0.03741	0.03116	0.02459	2.7%	3.1%	3.6%
75 – 79	0.06769	0.06057	0.05167	0.04284	2.2%	2.7%	3.0%
80 – 84	0.11005	0.09739	0.08601	0.07367	2.4%	2.4%	2.6%
85 – 89	0.15706	0.15670	0.14384	0.13158	0.0%	0.9%	1.2%
90 – 94	0.22704	0.24140	0.23390	0.20758	-1.2%	-0.3%	0.6%

Female

Age Band	Mid Point q-rate				Improvement from 1990-92		
	1990-92	1995-97	2000-02	2005-07	1995-97	2000-02	2005-07
20 – 24	0.00053	0.00048	0.00037	0.00036	2.0%	3.5%	2.5%
25 – 29	0.00049	0.00043	0.00038	0.00025	2.6%	2.5%	4.4%
30 – 34	0.00064	0.0005	0.00046	0.00037	4.8%	3.2%	3.6%
35 – 39	0.00087	0.00068	0.00061	0.00066	4.8%	3.5%	1.8%
40 – 44	0.00147	0.00104	0.00094	0.00103	6.7%	4.4%	2.3%
45 – 49	0.00237	0.0018	0.00155	0.00150	5.4%	4.2%	3.0%
50 – 54	0.00380	0.00314	0.00249	0.00226	3.7%	4.1%	3.4%
55 – 59	0.00590	0.00497	0.00413	0.00350	3.4%	3.5%	3.4%
60 – 64	0.00902	0.00761	0.00675	0.00557	3.3%	2.9%	3.2%
65 – 69	0.01446	0.01236	0.01059	0.00912	3.1%	3.1%	3.0%
70 – 74	0.02444	0.02092	0.01771	0.01558	3.1%	3.2%	3.0%
75 – 79	0.03929	0.03575	0.03150	0.02792	1.9%	2.2%	2.3%
80 – 84	0.07145	0.06413	0.05637	0.05101	2.1%	2.3%	2.2%
85 – 89	0.11552	0.11353	0.10213	0.09711	0.3%	1.2%	1.2%
90 – 94	0.19241	0.18931	0.18306	0.17744	0.3%	0.5%	0.5%

The corresponding rates from the NZ04 mortality study are shown below. Note that the expected used for comparison is the average q-rate for that age band over the whole period. Note that the analysis was performed for each age before being totalled into age bands (thus no distortion should have arisen if the age mix within an age band has changed).

Age Band	qx					Ratio (actual:expected)				
	1993 - 1995	1996 - 1998	1999 - 2001	2002 - 2004	2005 - 2007	1993 - 1995	1996 - 1998	1999 - 2001	2002 - 2004	2005 - 2007
MALES										
ALL						128%	114%	99%	95%	81%
20 - 24	0.0012	0.0010	0.0008	0.0007	0.0010	121.7%	101.3%	86.0%	72.7%	106.3%
25 - 29	0.0009	0.0009	0.0007	0.0008	0.0011	110.9%	112.9%	84.6%	91.7%	135.4%
30 - 34	0.0008	0.0009	0.0007	0.0007	0.0005	106.2%	126.5%	97.0%	99.0%	69.9%
35 - 39	0.0009	0.0007	0.0008	0.0009	0.0010	110.3%	82.7%	96.9%	117.7%	127.0%
40 - 44	0.0012	0.0010	0.0009	0.0009	0.0010	122.4%	99.7%	91.1%	90.7%	97.8%
45 - 49	0.0024	0.0018	0.0015	0.0019	0.0014	132.3%	102.0%	82.4%	105.5%	76.4%
50 - 54	0.0037	0.0034	0.0025	0.0022	0.0021	133.5%	121.2%	90.9%	79.8%	75.5%
55 - 59	0.0055	0.0050	0.0045	0.0039	0.0036	125.7%	114.3%	101.3%	88.5%	81.7%
60 - 64	0.0103	0.0099	0.0078	0.0072	0.0058	131.0%	125.6%	99.1%	90.9%	73.4%
65 - 69	0.0186	0.0165	0.0133	0.0120	0.0100	135.0%	119.5%	96.3%	87.0%	72.8%
70 - 74	0.0339	0.0280	0.0238	0.0232	0.0207	134.7%	111.5%	94.6%	92.1%	82.1%
75 - 79	0.0594	0.0481	0.0458	0.0381	0.0325	139.3%	112.9%	107.4%	89.5%	76.1%
80 - 84	0.0864	0.0844	0.0719	0.0683	0.0597	121.6%	118.7%	101.2%	96.1%	84.0%
85 - 89	0.1393	0.1257	0.1172	0.1167	0.0907	124.0%	111.9%	104.3%	103.9%	80.8%
90 - 94	0.2037	0.1824	0.1683	0.1741	0.1367	124.3%	111.3%	102.7%	106.3%	83.4%
FEMALES										
ALL						140%	126%	98%	102%	74%
20 - 24	0.0006	0.0005	0.0003	0.0004	0.0002	154.5%	115.5%	65.7%	94.9%	54.3%
25 - 29	0.0005	0.0006	0.0002	0.0003	0.0002	141.9%	179.5%	54.0%	72.4%	58.5%
30 - 34	0.0005	0.0006	0.0003	0.0003	0.0004	116.1%	143.9%	75.4%	75.7%	103.0%
35 - 39	0.0005	0.0005	0.0005	0.0006	0.0006	94.0%	103.6%	90.0%	112.5%	121.8%
40 - 44	0.0015	0.0007	0.0010	0.0008	0.0007	156.8%	76.3%	97.6%	84.2%	73.5%
45 - 49	0.0022	0.0017	0.0012	0.0011	0.0013	142.8%	115.2%	82.7%	72.2%	86.8%
50 - 54	0.0032	0.0028	0.0020	0.0019	0.0016	142.9%	125.1%	89.0%	87.1%	72.0%
55 - 59	0.0042	0.0041	0.0031	0.0036	0.0030	122.8%	118.6%	90.6%	105.3%	86.2%
60 - 64	0.0069	0.0071	0.0050	0.0054	0.0039	130.5%	134.7%	94.1%	101.5%	74.3%
65 - 69	0.0115	0.0118	0.0103	0.0088	0.0080	120.8%	124.1%	108.3%	91.9%	83.7%
70 - 74	0.0148	0.0176	0.0130	0.0189	0.0093	105.2%	124.8%	91.8%	134.2%	65.6%
75 - 79	0.0374	0.0300	0.0204	0.0250	0.0197	159.8%	127.8%	87.0%	106.8%	84.3%
80 - 84	0.0488	0.0524	0.0430	0.0423	0.0259	131.3%	141.2%	115.9%	114.0%	69.8%
85 - 89	0.1072	0.0729	0.0824	0.0736	0.0448	164.0%	111.5%	126.0%	112.6%	68.5%
90 - 94	0.1659	0.0773	0.1123	0.0802	0.0776	187.6%	87.5%	127.0%	90.8%	87.7%

Appendix 8 – Select Results

The number of claims by duration (split by product type and sex) were:

Type	Sex	Expected Deaths					Actual Deaths					Ratio Actual:Expected				
		0	1	2	3	Ult	0	1	2	3	Ult	0	1	2	3	Ult
1	M	14	18	21	22	13,999	9	11	9	14	9,482	64%	62%	44%	63%	68%
	F	5	6	7	7	2,449	0	2	3	0	1,355	0%	33%	46%	0%	55%
2	M	1	1	2	2	110	1	0	2	0	49	84%	0%	118%	0%	45%
	F	0	1	1	1	35	0	1	0	1	17	0%	176%	0%	136%	48%
3	M	57	64	64	59	497	10	16	10	20	297	17%	25%	16%	34%	60%
	F	30	35	39	38	233	4	6	7	10	194	13%	17%	18%	26%	83%
4	M	15	11	7	6	570	11	3	3	4	143	72%	28%	42%	65%	25%
	F	9	6	4	4	120	3	1	0	1	39	33%	16%	0%	28%	32%
5	M	379	390	400	403	2,523	157	210	191	204	1,425	41%	54%	48%	51%	56%
	F	178	185	190	193	1,158	63	81	99	101	748	35%	44%	52%	52%	65%
6	M	91	125	167	209	1,446	109	172	256	283	1,962	120%	137%	153%	136%	136%
	F	84	111	142	174	1,456	79	118	207	229	1,810	94%	106%	146%	131%	124%
7	M	14	17	17	21	287	10	8	13	8	239	71%	47%	77%	39%	83%
	F	12	16	16	20	223	9	5	4	8	208	76%	31%	26%	41%	93%
TERM	M	451	465	471	468	3,589	178	229	204	228	1,865	39%	49%	43%	49%	52%
	F	217	227	234	234	1,511	70	88	106	112	981	32%	39%	45%	48%	65%

The results for TERM are the total of Types 3, 4, and 5 (Level, YRT, and MRI).

The variance between smokers and other (non-smoker and aggregate) for Term is detailed in the tables below.

MALES						
No/Agg	In Force		Claims		Raw q-rate	
Age Band	Select	Ult	Select	Ult	Select	Ult
Under 30	75,623	18,919	30	11	0.0004	0.0006
30 - 40	209,026	137,198	84	74	0.0004	0.0005
40 - 50	215,193	337,319	173	300	0.0008	0.0009
50 - 60	115,972	291,048	221	610	0.0019	0.0021
60+	25,060	80,539	138	535	0.0055	0.0066
All Ages	640,873	865,021	646	1,530	0.0010	0.0018
Smoker	In Force		Claims		Raw q-rate	
Age Band	Select	Ult	Select	Ult	Select	Ult
Under 30	18,244	4,116	17	4	0.0009	0.0010
30 - 40	42,591	22,514	29	22	0.0007	0.0010
40 - 50	37,970	40,803	59	74	0.0016	0.0018
50 - 60	15,334	26,749	55	133	0.0036	0.0050
60+	2,316	6,671	33	102	0.0143	0.0153
All Ages	116,453	100,852	193	335	0.0017	0.0033
Total	In Force		Claims		Raw q-rate	
Age Band	Select	Ult	Select	Ult	Select	Ult
Under 30	93,867	23,034	47	15	0.0005	0.0007
30 - 40	251,617	159,711	113	96	0.0004	0.0006
40 - 50	253,162	378,121	232	374	0.0009	0.0010
50 - 60	131,305	317,797	276	743	0.0021	0.0023
60+	27,376	87,210	171	637	0.0062	0.0073
All Ages	757,326	965,873	839	1,865	0.0011	0.0019

Note that for both Select and Ultimate the raw mortality rates for male smokers are very broadly double the rates for non-smokers.

For females the impact of smoking on mortality appears even higher.

FEMALES						
No/Agg	In Force		Claims		Raw q-rate	
Age Band	Select	Ult	Select	Ult	Select	Ult
Under 30	86,428	20,459	14	4	0.0002	0.0002
30 - 40	214,857	154,338	57	69	0.0003	0.0004
40 - 50	180,060	274,328	77	196	0.0004	0.0007
50 - 60	75,363	167,727	67	320	0.0009	0.0019
60+	13,387	35,245	60	172	0.0045	0.0049
All Ages	570,094	652,096	275	761	0.0005	0.0012
Smoker	In Force		Claims		Raw q-rate	
Age Band	Select	Ult	Select	Ult	Select	Ult
Under 30	20,411	4,907	2	3	0.0001	0.0006
30 - 40	38,275	25,532	19	21	0.0005	0.0008
40 - 50	31,063	36,274	39	71	0.0013	0.0020
50 - 60	10,480	17,949	25	87	0.0024	0.0048
60+	1,363	3,459	16	38	0.0117	0.0110
All Ages	101,592	88,120	101	220	0.0010	0.0025
Total	In Force		Claims		Raw q-rate	
Age Band	Select	Ult	Select	Ult	Select	Ult
Under 30	106,839	25,365	16	7	0.0001	0.0003
30 - 40	253,132	179,870	76	90	0.0003	0.0005
40 - 50	211,123	310,601	116	267	0.0005	0.0009
50 - 60	85,843	185,676	92	407	0.0011	0.0022
60+	14,750	38,704	76	210	0.0052	0.0054
All Ages	671,686	740,216	376	981	0.0006	0.0013

The comparison for 5 year age bands is summarised below. Note that the small number of smoker claims means that a more detailed examination cannot be made.

Ratio S:NS Age Band	MALES			FEMALES		
	Select	Ult	Total	Select	Ult	Total
30 - 34	228%	128%	189%	267%	78%	172%
35 - 39	192%	190%	189%	139%	235%	189%
40 - 44	201%	182%	189%	240%	201%	209%
45 - 49	183%	196%	186%	338%	346%	336%
50 - 54	170%	210%	186%	269%	266%	259%
55 - 59	171%	201%	181%	305%	269%	267%
60 - 64	171%	198%	179%	185%	324%	287%
65 - 69	168%	197%	177%	657%	249%	329%