

The New Zealand Society of Actuaries

**Report on the Investigation into the
Mortality of New Zealand Insured Lives
1998-2001**

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Consulting Actuaries

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1. Introduction

1.1 Background

The last New Zealand insured lives experience investigation related to a five year period from 1 January 1993 to 31 December 1997. The report, in 1998, presented mortality tables known as NZ97.

The Committee of the New Zealand Society of Actuaries decided that reporting on experience every year or every second year was not necessary or appropriate. In 2000, it was agreed that a new investigation should be carried out. This relates to the period from 1 January 1998 to 31 December 2001. The work of collection and processing of new experience data was put out to tender and Melville Jessup Weaver was appointed to carry out the project.

1.2 The contributors

The Society wishes to thank the following organisations for their contributions of data and/or funds towards the New Zealand mortality investigation:

- AMP
- AXA
- BNZ Life
- Cigna
- Farmers' Mutual Life
- Fidelity Life
- NBNZ Life
- Royal & SunAlliance
- Southsure Assurance
- Sovereign
- Tower Life
- Tower Health & Life
- WestpacTrust Life

1.3 The purpose of the report

The purpose of this report is to provide an analysis of the current mortality of New Zealand insured lives, as a comparison to that shown in previous investigations.

This report will be presented to the New Zealand Society of Actuaries biennial conference to be held in November 2002.

1.4 The format of the report

The format and layout are broadly similar to those used in previous studies. However, for reasons discussed within this report, no graduation of the mortality rates has been made. The results of this investigation are presented with comparisons of the crude mortality rates to the graduated rates of the most recent previous study.

1.5 The period of investigation

For the previous investigation, companies were asked to contribute data for the five year period 1993 to 1997 inclusive. For the current investigation companies were asked to provide data for the period 1998 to 2001 inclusive.

It should be noted that use of a four year period of investigation, rather than the five years used in recent investigations, has meant an automatic reduction in the volume of data available for analysis. This is in addition to variations in the volume and mix of exposures resulting from changes in the participating companies and in their business.

It needs to be noted that a number of companies submitted data relating to their own company financial years, rather than providing data over each calendar year. As previously, the data for each of the company years has been amalgamated with the most closely corresponding calendar year. 21% of the exposure relates to non-calendar years. It is not expected that this mis-matching of observation periods will have any material effect on the results.

1.6 Uses for the results

The analysis of mortality and morbidity experience is vital to the New Zealand life insurance industry. All life offices operating in New Zealand will benefit from a better appreciation of industry experience as a whole, and their own experience relative to the industry aggregate. The results should be of value in setting future assumptions for pricing and valuation.

1.7 Data collection

Eleven companies have provided data for the 2001 investigation of which eight were able to provide data for the full four years. One company was able to provide data for three years for part of its portfolio, and for four years for the remainder. One company supplied data for two years and one company supplied data for one year.

Due to mergers and acquisitions the number of companies involved is not directly comparable with numbers contributing to previous investigations. Unfortunately, for various reasons, data for some companies that participated in previous investigations was not able to be included in this investigation.

The average mortality relates to a slightly more recent time than a simple midpoint of the period of observation. Whilst it is acknowledged that this might introduce a small element of bias into the results, it is not anticipated that this will invalidate the results in any significant way. It is believed that the additional credibility gained by including as much data as possible outweighs any possible disadvantages.

1.8 Future investigations

If it is anticipated that experience investigations will be carried out regularly in future, it is strongly recommended that data should be submitted annually by each company. This routine should make the provision of data for each year easier and enable more timely validity checks to be carried out. The processing of the data would be deferred until the next investigation.

1.9 Naming convention

The previously established convention assigns the prefix NZ to the mortality tables produced by investigations such as this. Also, the final year of the investigation period is used to identify the particular data used. Thus, the name NZ97 related to the period 1993–1997, and was not intended to imply that the mortality relates solely to the 1997 year.

As indicated above, the present results are in the form of ungraduated experience, rather than the graduated mortality tables presented in previous years. However, for convenience, NZ01M and NZ01F are used in this report as a means of indicating the results of this investigation for male and female lives respectively.

1.10 Rounding convention

Where percentages have been shown in the tables in this report, they have been rounded to the nearest integer, which may mean that the sum of the components does not total 100%. This approach was felt to be more appropriate than arbitrarily adjusting the percentages for presentation purposes.

1.11 Disclaimer

Certain checks have been carried out on the data on which this report is based. Nevertheless, the Society cannot accept any responsibility for errors or for the use or misuse of any information in this report.

In particular, actuaries and others using the results should exercise professional care and judgement in ensuring that they are suitable for the intended purpose.

The results shown are the aggregate of all participating offices and of the different policy types (as indicated) over the period for which data were submitted and caution should be exercised when applying these results to any one particular office or policy type. The purpose of this investigation is to provide an industry wide benchmark against which offices can check their own individual experience, and apply their own appropriate adjustments.

When using the information supplied in this report, it needs to be remembered that the graduated rates and other results shown are based on limited data at certain ages. It would therefore be inappropriate to place too much reliance on the tail ends of the tables. Care needs to be applied in interpretation and use.

2. The data

2.1 Data integrity

It is of the utmost importance in an investigation such as this to ensure that the data is credible and as free from error as possible. To this end reliance was placed upon each office's Actuary to verify the accuracy of the data. In addition to overseeing the data extraction process, each office's Actuary was requested to apply reasonableness checks to the data.

Nevertheless, Melville Jessup Weaver applied various validation checks to the data provided. Where obvious errors were revealed, the data was either sent back to the office to be amended, edited, or (for a small amount of data) discarded.

2.2 Unit of exposure

The investigation has been based on policies rather than lives. The total exposure for the whole period of investigation amounted to 5,410,629 policy years. Although data were also collected on sums assured, at this stage no analysis has been done to look at the effect of using these as the unit of exposure. This may be considered in the future.

2.3 The rate interval

For the purposes of the investigation, it was decided that the most appropriate rate interval is the life year. Deaths were classified by age last birthday at the date of death. Therefore at the beginning of the rate interval all lives were aged "x" nearest.

2.4 Data classification

Offices were asked to categorise their data according to policy type, gender, underwriting basis, HIV testing status, smoking status, mortality loading, the range of trauma covers included, the form of TPD cover included and occupation class. Although the exposure in some cells is very limited, a certain amount of analysis has been done to examine most of these factors.

Summary information on data by policy type and duration is given in the following paragraphs of this section of the report. More detailed information, including analysis of the exposures by other factors, may be found in the tables of Section 5.

2.5 Types of policy excluded from the investigation

The following classes of policy have been excluded from the data supplied by each company:

- (i) Policies with no or nominal amounts of cover e.g. insurance bonds with a nominal death benefit,
- (ii) 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),
- (iii) Reinsurance received from other companies,
- (iv) Child's deferred policies,
- (v) Policies which were issued as Industrial or Collector business,
- (vi) Group policies, and
- (vii) Joint and contingent life policies.

2.6 The data by policy type

The data were sub-divided by policy type, classified as follows:

- (i) Whole of life and endowment insurances, both with and without term insurance riders,
- (ii) Unbundled policies, both of the capital guaranteed and investment-linked kinds as long as the policies carry significant death/trauma/TPD risk. Where a policy has variable life cover that moves above and below this level, the policy has been treated consistently from year to year,
- (iii) Temporary insurances where premiums are fully guaranteed; the sums insured may be level or reducing,
- (iv) Temporary insurances where the premium rate may be reviewed, and
- (v) Mortgage repayment insurance.

The change in the mix of types of policies included in the aggregate data between the 97 and 01 investigations is considerable. This is shown in the table below.

Policy type	% of 97 exposure	% of 01 exposure
(i)	55	45
(ii)	13	8
(iii)	9	15
(iv)	14	23
(v)	10	8
Total	100	100

The exposure by policy type and by age group, in aggregate and by gender, is illustrated in graphs in Section 7.

The total exposure in policy years in this investigation for each policy type is shown in the table below.

Policy type	Exposure	%	Average age	Claims	%
(i)	2,435,098	45	46.4	15,418	78
(ii)	425,183	8	41.6	755	4
(iii)	837,675	15	42.8	2,009	10
(iv)	1,254,536	23	40.0	1,206	6
(v)	458,138	8	44.0	382	2
Total	5,410,629	100	43.8	19,770	100

The exposure on which this report is based is 22% lower than that underlying the last investigation. Most of this can be explained by the reduction in the period covered by the investigation. However, as previously noted there have also been changes in the composition of the companies contributing to the investigation.

The overall average age has increased by two years. All policy types have an increase in average age, the largest increase of 3.4 years occurring for policy type (i).

2.7 Exposure by duration

The data were also sub-divided by duration and gender. Proportions for each policy type are set out in the following table.

Males	Duration (years)					
	0	1	2	3	4	5+
Policy type	%	%	%	%	%	%
(i)	1	2	2	2	2	89
(ii)	6	5	4	5	6	74
(iii)	17	14	12	9	8	39
(iv)	21	19	16	12	10	22
(v)	6	4	2	1	1	87
Average	8	7	6	5	5	68

Females	Duration (years)					
	0	1	2	3	4	5+
Policy type	%	%	%	%	%	%
(i)	3	4	4	4	4	82
(ii)	8	6	5	6	6	69
(iii)	20	16	14	10	8	31
(iv)	23	20	16	12	9	19
(v)	15	9	4	2	1	69
Average	13	12	10	8	7	51

The policy types (i), (ii) and (iv) show increased maturity since the last investigation, but types (iii) and (v) indicate significant volumes of new business.

3. The results of the present investigation

3.1 Introduction

As noted, a significant shift has occurred in the mix of policy types included in the aggregate business since the last investigation was recorded. As a result, it was decided that the value of detailed analysis of aggregate results was limited. Taking into account the results of the 97 and 01 investigations and the exposures in each age and policy cell, it was determined that graduated NZ01 mortality tables would not be produced as an integral part of this report. Instead, comprehensive comparisons are presented of the NZ01 results with the NZ97 experience.

3.2 Aggregate results

Care is necessary in consideration of or in comparisons between aggregated results. The total exposure, observed deaths and crude aggregate mortality rates have been tabulated in Section 6. The crude rates for males NZ01M and for females NZ01F are shown graphically in Section 7 and compared to the graduated aggregate rates NZ97M and NZ97F respectively.

The table below shows a comparison by 5 year age groups of the actual NZ01 experience with that expected according to the graduated aggregate NZ97 tables and the Australian insured lives tables IA90-92 and IA95-97.

Age	NZ01 mortality as percentage of expected under published tables					
	Males			Females		
	NZ97M %	IA90-92M %	IA95-97M %	NZ97F %	IA90-92F %	IA95-97F %
Up to19	77	90	111	92	94	134
20 – 24	85	121	108	62	100	104
25 – 29	79	104	90	81	103	108
30 – 34	76	76	79	77	88	90
35 – 39	85	77	90	93	113	107
40 – 44	73	67	87	80	101	93
45 – 49	71	71	96	79	97	98
50 – 54	66	72	92	85	97	118
55 – 59	71	82	100	86	104	125
60 – 64	76	87	102	74	92	104
65 – 69	78	85	97	98	122	135
70 – 74	81	85	95	94	120	133
75 – 79	91	93	101	72	89	94
Over 80	82	84	88	79	86	84
Average	79	83	94	83	99	106
97 average	100	104		100	121	

Overall the NZ01 experience shows an improvement of 21% over NZ97 for males, with females improving by 17%. This improvement seems to be fairly consistent across all age groups where there is a reasonable volume of exposures. The pattern for older age groups is unclear.

It may be noted that in the comparison with previous New Zealand experience, the age band 35-39 appears to be inconsistent with the general trend. This cohort of lives (then in the age group 30-35) had shown somewhat less than expected improvement in experience in comparisons made in the 1997 investigation as well. There is no ready explanation for this feature.

The significant improvement indicated at all ages prompted a comparison of recent New Zealand Population Life tables. These indicate that a mortality improvement of the order of 2.5% to 3% per annum occurred during the first half of the 1990's. This is rather less than seems to be indicated by this investigation for insured lives.

The 'accident hump' for New Zealand males is apparent in the comparison with IA90-92.

The differences apparent in the comparisons with the two Australian tables reflect changes in the patterns of mortality reflected in those tables. It appears that mortality deteriorated for young males in Australia, possibly associated with extension of the accident hump. However, there were significant improvements in the middle ages, so that there is no significant relative gain in the New Zealand comparison in this area.

In the 1997 investigation it was noted that male mortality was slightly worse than the Australian experience, but female mortality was significantly worse by approximately 20% across virtually all age bands. This phenomenon was noted as being consistent with differences in New Zealand and Australian population mortality. No new comparison of population rates has been carried out for this report. However, the improvement in female lives indicated in the Australian tables is relatively small, and there was some deterioration for those aged 35-45 and over 80. Thus, although New Zealand female assured lives mortality remains worse than that of Australian females, the gap appears to have closed somewhat at most ages.

It was noted in the previous investigation that there were significant differences in the mortality rates observed between classes of business. Therefore because of the changes that have occurred in the mix of classes within the aggregate exposure, it was decided that attention should be directed in this investigation towards the patterns of changes in mortality by gender and policy type.

3.3 Female to Male mortality

The table below compares NZ01F female mortality to NZ01M male mortality. The similar results from the 97 report are given for comparison.

Age	NZ01F/NZ01M %	NZ97F/NZ97M %
Up to 19	55	47
20 – 24	30	41
25 – 29	42	40
30 – 34	57	56
35 – 39	83	75
40 – 44	88	81
45 – 49	86	78
50 – 54	94	73
55 – 59	83	69
60 – 64	65	66
65 – 69	80	64
70 - 74	73	63
75 - 79	50	63
Over 80	65	65
Average	70	67

3.4 Mortality by policy type

In view of the changes in the mix of the exposures between investigations, analysis by policy type is considered as more important than that of the aggregate data.

For the purposes of analysis by policy type, the data was sub-divided into three groups:

- (a) Whole of Life, Endowment and Unbundled Contracts, (i.e. types (i) and (ii)),
- (b) Temporary Assurances whether premium rates are guaranteed or not, (i.e. types (iii) and (iv)), and
- (c) Mortgage Repayment Insurances (i.e. type (v)).

In previous investigations, the separate policy type category for Mortgage Repayment Insurances was created on the basis that the majority of this line of business was taken out by single premium at the time of accepting a mortgage and there may be significant under-reporting of claims. The exposure in type (c) is comparatively small, and this should be kept in mind when trying to draw conclusions in regard to these policies.

As mentioned elsewhere in this report, there may be some changes in the nature of the business now being written that introduces elements of heterogeneity within the general groups currently being analysed. It may be that the categorisation of policies should be reviewed for future investigations. However, it could be difficult for some companies to reclassify existing policies.

The tables below show the ratios of actual NZ01 experience to that expected using NZ97 for each gender and each of the above policy type groups.

Male	NZ01/NZ97			(b) to (a)
	(a)	(b)	(c)	
Age:	%	%	%	%
Up to 19	74	38	0	51
20 – 24	92	65	72	71
25 – 29	80	77	54	96
30 – 34	82	72	57	88
35 – 39	78	99	56	127
40 – 44	85	79	30	94
45 – 49	82	70	42	85
50 – 54	75	59	36	79
55 – 59	75	67	41	89
60 – 64	79	71	43	91
65 – 69	79	82	19	105
70 – 74	80	97	0	121
75 – 79	91	87	0	96
Over 80	82	87	N/A	106
Average	81	74	39	91
97 average	102	72	79	70

Female	NZ01/NZ97			(b) to (a)
	(a)	(b)	(c)	
Age:	%	%	%	%
Up to 19	82	99	0	121
20 – 24	75	36	239	48
25 – 29	83	81	61	97
30 – 34	62	84	84	134
35 – 39	110	88	66	80
40 – 44	96	71	78	74
45 – 49	77	89	30	115
50 – 54	93	79	44	86
55 – 59	90	77	87	85
60 – 64	82	60	13	73
65 – 69	106	79	0	75
70 – 74	100	80	0	79
75 – 79	74	67	N/A	90
Over 80	80	77	N/A	97
Average	87	78	55	89
97 average	109	67	88	62

The comparison between types of business was included for the first time in the NZ97 investigation. This showed a significantly lower level of mortality for type (b) as compared to type (a) policies.

The possible effects of variations in durations between types of policies are considered in Section 4.

The table below indicates the relative mortality for the policy type groups in the 01 and 97 investigations.

	NZ01M (b) to (a)	NZ97M (b) to (a)	NZ01F (b) to (a)	NZ97F (b) to (a)
Age:	%	%	%	%
Up to 19	51	106	121	125
20 - 24	71	74	48	22
25 - 29	96	66	97	60
30 - 34	88	53	134	64
35 - 39	127	81	80	73
40 - 44	94	68	74	53
45 - 49	85	62	115	55
50 - 54	79	74	86	61
55 - 59	89	82	85	54
60 - 64	91	61	73	70
65 - 69	105	67	75	57
70 - 74	121	84	79	68
75 - 79	96	68	90	19
Over 80	106	56	97	247
Average	91	70	89	62

The difference in mortality between types of policy indicated by the NZ01 investigation is much less marked than in the NZ97 investigation. Since the type (a) policies are generally of many years past duration, it is unexpected that the improvement in mortality for these policies appears to be more than that for the New Zealand population at most ages.

The improvement for the type (b) policies seems to be rather less than that for the type (a) policies. One reason for these results may be some underlying variation in the nature of the business being included in the within these classes. For example, some offices may be including direct mail temporary business with their class (iii) returns now.

The results for the individual cohorts of males aged 35-39, and females aged 30-35 given here again show the inconsistency that has been remarked upon earlier in this report.

3.5 Smoker and Non-smoker mortality

The table below shows, for each gender, the observed actual to expected claims ratios under NZ01 for smoker compared to aggregate, non-smoker compared to aggregate and smoker compared to non-smoker. Because of the small exposure size, there is a large degree of variation in the ratios by age. The overall ratio of smoker to non-smoker mortality of 177% for males can be compared to 120% in the NZ97 investigation. The corresponding female results are 176% and 162%. It was noted in the previous report that ratios of 180% (males) and 153% (females) were observed in IA92-94 for durations 2 and over.

	Male			Female		
	Smoker to Aggregate	Non-Smoker to Aggregate	Smoker to Non-Smoker	Smoker to Aggregate	Non-Smoker to Aggregate	Smoker to Non-Smoker
Age:	%	%	%	%	%	%
Up to 19	125	16	774	0	172	0
20 – 24	81	72	113	26	50	53
25 – 29	118	61	193	155	53	293
30 – 34	87	69	125	87	86	101
35 – 39	138	79	173	133	73	181
40 – 44	135	57	235	75	70	107
45 – 49	96	57	170	162	68	237
50 – 54	112	48	231	145	67	216
55 – 59	107	57	187	115	69	168
60 – 64	124	63	198	99	51	194
65 – 69	85	78	109	134	77	175
70 – 74	121	88	137	194	76	255
75 – 79	137	79	174	85	65	131
Over 80	96	84	115	116	78	150
Average	113	64	177	122	69	176

The above table does include a few odd values. These generally relate to cells where there is a low level of exposure. As a result, the figures should be treated with a high degree of caution, especially those for female lives.

3.6 Claims by cause of death

Companies were asked to classify claims by cause of death, where known. As can be seen from the table below, there are significant numbers of claims for which the cause of death has not been submitted.

Cause	Male %	Female %	Total %
Infectious and Parasitic Diseases	1	0	1
Neoplasms	17	18	17
Endocrine, Nutritional & Metabolic Diseases & Immunity Disorders	0	0	0
Diseases of the Blood and Blood Forming Organs	0	0	0
Mental Disorders	1	0	1
Diseases of the Nervous System & Sense Organs	1	1	1
Diseases of the Circulatory System	26	12	24
Diseases of the Respiratory System	7	5	7
Diseases of the Digestive System	1	1	1
Diseases of the Genitourinary System	1	1	1
Complications of Pregnancy, Childbirth & the Puerperium	0	0	0
Diseases of the Skin & Subcutaneous Tissue	0	0	0
Diseases of the Musculo-skeletal System & Connective Tissue	0	0	0
Congenital Anomalies	0	0	0
Certain Conditions Originating in the Perinatal Period	0	0	0
Symptoms, Signs & Ill Defined Conditions	4	2	3
External Causes of Injury and Poisoning	3	4	3
Unclassified	38	56	41
Total	100	100	100

In view of the fact that many companies are unable to contribute to this part of the investigation, the data must be treated with a certain amount of caution. Although there has been improvement in the proportion of classified claims since the last investigation, it is a little disappointing that the proportion of unclassified claims remains quite large. It is hoped that more companies will capture this data item in future as part of their ongoing claims administration so that future investigations may present meaningful results in this area.

4. Select rates

4.1 Introduction

The effect of temporary initial selection is quite significant, especially at the very early durations.

NZ97 graduated tables are aggregate tables in the sense that they include policies of all durations. They are not tables of ultimate rates that show mortality with the effect of temporary initial selection removed. Analysis was carried out to illustrate the effects of selection in the NZ97 data. This was discussed in the report on that investigation, and a set of tables quantifying the lighter mortality at the earlier durations was produced.

Comparison by age groups at each duration has been made using the NZ01 crude mortality rates for male and female aggregate of all policies and for type (b) policies only.

4.2 The select period

For the NZ97 investigations a number of statistical tests were performed on the data which showed:

- *very strong* evidence of lighter mortality than ultimate for durations 0 and 1,
- *strong* evidence of lighter mortality than ultimate for durations 2,3 and 4,
- *some* evidence of lighter mortality than ultimate for durations 5 and 6, and
- *little or no* evidence of lighter mortality than ultimate thereafter.

On the basis of this analysis it was decided, for practical reasons, to produce NZ97 tables with a 5 year select period. The increased difficulty of producing tables with a longer select period was deemed likely to outweigh any greater usefulness they may have had, especially as the evidence of different mortality is far from conclusive.

The NZ01 investigation does not show such clear evidence regarding select periods.

4.3 Mortality by policy type for ultimate durations

In examining the relative mortality rates by type of policy shown by NZ97, there was concern that the apparent differences in mortality between temporary assurances and other contracts might merely reflect the fact that in general temporary assurances are more heavily concentrated at the shorter durations.

In order to test whether this was in fact the case, the experience using only the ultimate duration policies was compared. Similar results for NZ01 are shown in the following tables.

Male	(a) to NZ97Ult	(b) to NZ97Ult	(c) to NZ97Ult	(b) to (a)
Age:	%	%	%	%
Up to 19	76	97	0	128
20 - 24	81	59	0	73
25 - 29	73	129	0	177
30 - 34	86	62	35	72
35 - 39	80	95	49	119
40 - 44	85	76	29	90
45 - 49	79	58	42	73
50 - 54	76	65	35	85
55 - 59	73	71	42	96
60 - 64	76	62	42	82
65 - 69	74	62	20	84
70 - 74	77	118	0	153
75 - 79	89	104	0	117
Over 80	81	105	n/a	129
Average	80	71	38	89

Female	(a) to NZ97Ult	(b) to NZ97Ult	(c) to NZ97Ult	(b) to (a)
Age:	%	%	%	%
Up to 19	88	0	0	0
20 - 24	57	0	0	0
25 - 29	49	59	0	120
30 - 34	47	48	101	103
35 - 39	109	77	47	70
40 - 44	94	85	78	90
45 - 49	75	87	24	116
50 - 54	83	82	45	99
55 - 59	73	96	92	133
60 - 64	70	47	0	67
65 - 69	97	137	0	141
70 - 74	83	105	0	126
75 - 79	71	93	n/a	130
Over 80	83	77	n/a	93
Average	80	84	51	105

It is very difficult to discern any clear patterns from these tables. The difference between type (a) and type (b) policies is far less apparent than in the previous investigation, even in the more populous middle age groups. These results reflect those already noted in relation to overall mortality rates for these types of business.

4.4 Effects of selection

In the previous report graduated select and ultimate tables were prepared using data for all policy types. It was noted that those rates were calculated on what was fairly sparse data. It was hoped that future investigations would be able to give a clearer idea of the true effect of temporary initial selection.

Due to the variations in mix of business, the overall reduction in level of exposures in the NZ01 investigation and the lack of clear mortality patterns emerging, it was felt that full investigation of select rates was inappropriate. However, to provide some information on this aspect of the results, graphs are provided in Section 8 to illustrate the relative levels of observed experience for the temporary assurance, type (b) policies, by gender by 5 year age groups for the select durations as compared to ultimate experience. It is noted that these are the policies for which there are the higher levels of exposures in the select years, as very few new type (a) (whole of life, endowment and unbundled) policies have been written in the investigation period.

It is difficult to discern distinct patterns from the analysis by individual age groups. A pattern does emerge when all ages are put together. However, the mortality for males for select duration 4 years appearing to be better than for duration 3 years was unexpected, as were the high relative levels at those durations.

Since there are limited numbers of exposures and deaths in the young and old age groups in the various select periods, a separate analysis focusing only on the central age group 25-50 was also carried out. The result for these ages shows that the mortality for select durations 3 and 4 years was better than in year 2 for males, and for select duration 4 years was better than in year 3 for females.

As suggested previously in this report, there may be some underlying variation in the nature of the business transacted in recent years, and hence now included within the returns for type (b) policies, that gives rise to the unusual features within these results.

Those using these results should be very aware of the nature of the limitations noted, and as always should cross check the validity from their own and other sources.

5. Tables relating to exposure categories

5.1 Exposure by year for each policy type

Exposure	1998	1999	2000	2001
Policy type:				
(i)	625,502	639,626	604,828	565,143
(ii)	118,002	114,732	100,699	91,751
(iii)	168,814	204,751	226,132	237,979
(iv)	202,905	291,764	356,399	403,468
(v)	93,224	115,821	126,593	122,500
Total	1,208,446	1,366,693	1,414,650	1,420,841
% of total	22	25	26	26

Exposure for the earlier years is slightly less than for the other years because a few companies were unable to provide data for all past years.

5.2 Proportions of policy types from year to year

Policy type	1998	1999	2000	2001
(i)	52%	47%	43%	40%
(ii)	10%	8%	7%	6%
(iii)	14%	15%	16%	17%
(iv)	17%	21%	25%	28%
(v)	8%	8%	9%	9%
Total	100%	100%	100%	100%

Claims by Policy type	1998	1999	2000	2001
(i)	80%	80%	76%	76%
(ii)	5%	4%	4%	3%
(iii)	8%	9%	12%	11%
(iv)	5%	5%	6%	8%
(v)	2%	2%	2%	2%
Total	100%	100%	100%	100%

5.3 Exposure by gender and policy type

The shift since the last investigation towards policy types (iii) and (iv), away from policy type (i), is reflected in the data for both genders. Average ages have increased for all categories.

Policy type	Male			Female			Unclassified		
	Exposure	%	Avg age	Exposure	%	Avg age	Exposure	%	Avg age
(i)	1,750,740	50	48.0	668,696	35	42.1	15,663	69	50.9
(ii)	255,931	7	42.4	169,253	9	40.5	0	0	-
(iii)	473,185	14	43.7	363,760	19	41.5	731	3	95.6
(iv)	677,208	19	41.2	577,324	31	38.6	4	0	46.5
(v)	346,391	10	44.7	105,366	6	41.7	6,381	28	45.4
Total	3,503,454	100	45.4	1,884,397	100	40.7	22,778	100	50.8

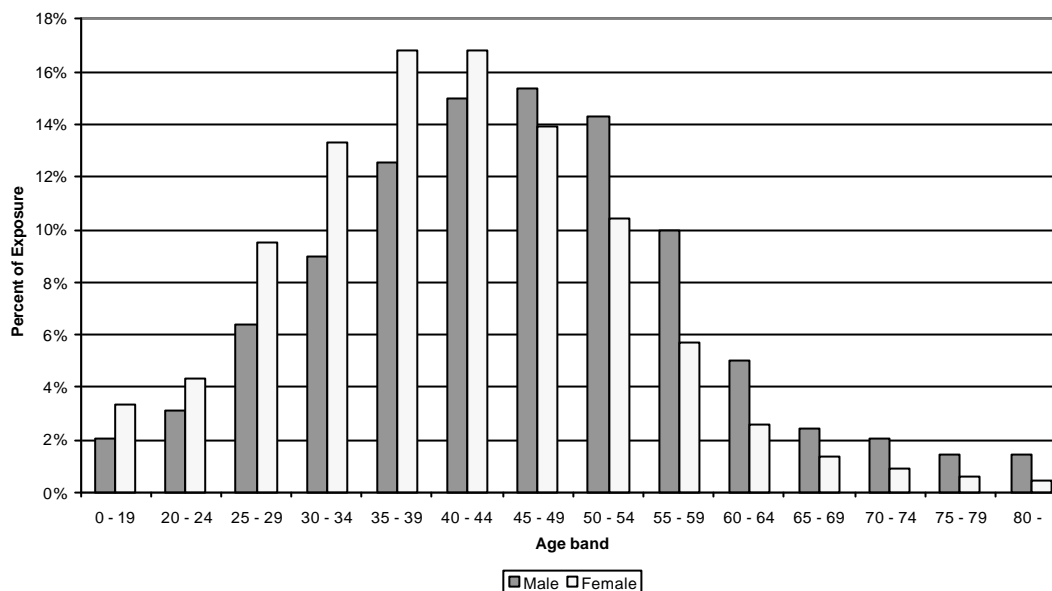
5.4 Exposure and claims by gender, by age groups

Male exposure is 26% lower than that in the 97 investigation, and female exposure is 11% lower.

Age	Male		Female		Unclassified	
	Exposure	Claims	Exposure	Claims	Exposure	Claims
Up to 19	72,287	35	62,459	16	14	0
20 - 24	108,821	99	81,631	22	8	0
25 - 29	223,985	154	178,465	51	181	1
30 - 34	313,303	172	251,435	78	978	2
35 - 39	439,363	298	316,521	177	2,724	8
40 - 44	524,766	454	317,280	242	3,883	9
45 - 49	538,059	768	261,967	321	4,577	11
50 - 54	500,216	1,140	195,931	419	3,958	19
55 - 59	349,660	1,524	107,967	388	2,622	23
60 - 64	175,601	1,403	48,291	248	1,338	11
65 - 69	86,146	1,254	25,137	291	666	12
70 - 74	70,780	1,832	17,531	329	444	7
75 - 79	51,398	2,474	11,610	278	230	2
Over 80	49,072	4,692	8,176	500	1,158	6
Total	3,503,454	16,299	1,884,397	3,360	22,778	111

The bar graph below shows, for each gender, the percentage of exposure in each age band. When looking at the bar graph it needs to be remembered that total male exposure is approximately 1.9 times that of females.

Distribution of In Force Policies Amongst Males and Females



5.5 Exposure by underwriting basis

The data for each gender and policy type have also been subdivided by underwriting basis. The proportion of unknowns has increased somewhat since the last investigation, when it was 66% for males and 63% for females.

Males	Underwriting basis					
	Policy type	Minimum Evidence %	Non-medical %	Medical %	Para-medical %	None %
(i)	15	1	1	0	2	82
(ii)	21	1	23	0	2	53
(iii)	6	13	43	0	0	39
(iv)	16	7	2	0	1	73
(v)	0	2	0	0	0	97
Average	11	5	14	0	1	69

Females	Underwriting basis					
	Policy type	Minimum evidence %	Non-medical %	Medical %	Para-medical %	None %
(i)	18	1	1	0	4	76
(ii)	23	1	28	0	1	47
(iii)	3	14	46	0	0	37
(iv)	17	8	1	0	1	73
(v)	0	1	0	0	0	99
Average	12	5	15	0	2	66

5.6 Exposure by smoking status

The data were also sub-divided by smoking status. However, many companies did not use this as a rating factor until the mid-1980s. In addition, it is believed that some companies have mis-classified some business, since their data includes a number of smokers at very young ages. They may have classified as smoker all business not written on a non-smoker basis, leading to overstatement of the smoker cells and understatement of "unknown".

The proportions of the exposure classified as smoker or non-smoker can be seen in the following table. The overall proportions unknown are much lower than those in the last investigation, which were 73% for males and 60% for females.

Policy type	Male			Female		
	Smoker	Non-smoker	Unknown	Smoker	Non-smoker	Unknown
	%	%	%	%	%	%
(i)	0	2	98	0	3	97
(ii)	12	43	44	13	47	40
(iii)	14	69	17	16	74	10
(iv)	17	83	0	18	82	0
(v)	6	55	39	12	57	31
Average	10	50	40	12	53	36

5.7 Exposure by HIV testing status

Very few lives insured have been HIV tested, and indeed the majority of policies are in the "unknown" category. This means that at this stage it is not worthwhile to attempt any analysis by HIV testing status.

HIV testing status	Males %	Females %	Total %
Tested	1	1	1
Not tested	32	32	32
Unknown	67	67	67
Total	100	100	100

5.8 Exposure by underwriting assessment

The following definitions were used for this subdivision:

- Standard - no loading applied
- Light sub-standard - a loading not greater than +75% and
- Heavy sub-standard - a loading greater than +75%.

Assessment Policy type	Males			Females		
	Std	Light sub-std	Heavy sub-std	Std	Light sub-std	Heavy sub-std
	%	%	%	%	%	%
(i)	99	1	0	99	1	0
(ii)	97	2	1	97	2	1
(iii)	96	2	1	96	2	1
(iv)	95	3	2	95	3	2
(v)	100	0	0	99	1	0
Total	97	2	1	97	2	1

Although the proportion of exposure subject to loadings remains very low, there appear to have been some significant increases in these since the previous investigation.

6. 2001 aggregate results by age

Age	NZ01M			NZ97M	NZ01F			NZ97F
	E_x	θ_x	q_x	\bar{q}_x	E_x	θ_x	q_x	\bar{q}_x
0	37	1	0.027397	0.000620	31	0	0.000000	0.000673
1	103	0	0.000000	0.000179	88	0	0.000000	0.000297
2	181	0	0.000000	0.000117	155	0	0.000000	0.000201
3	294	0	0.000000	0.000090	242	0	0.000000	0.000157
4	435	0	0.000000	0.000074	344	0	0.000000	0.000132
5	641	1	0.001560	0.000065	544	0	0.000000	0.000117
6	900	0	0.000000	0.000059	849	0	0.000000	0.000107
7	1,239	0	0.000000	0.000058	1,201	0	0.000000	0.000101
8	1,607	0	0.000000	0.000067	1,499	0	0.000000	0.000097
9	2,418	0	0.000000	0.000091	2,252	0	0.000000	0.000096
10	3,368	2	0.000594	0.000139	3,129	0	0.000000	0.000099
11	3,670	0	0.000000	0.000214	3,374	0	0.000000	0.000111
12	3,920	2	0.000510	0.000315	3,601	0	0.000000	0.000136
13	4,289	0	0.000000	0.000437	3,882	0	0.000000	0.000177
14	4,804	0	0.000000	0.000571	4,349	1	0.000230	0.000233
15	5,614	2	0.000356	0.000704	5,011	2	0.000399	0.000297
16	6,783	6	0.000885	0.000828	5,806	2	0.000345	0.000362
17	8,192	7	0.000855	0.000933	6,804	4	0.000588	0.000417
18	10,574	8	0.000757	0.001015	8,499	2	0.000235	0.000457
19	13,223	6	0.000454	0.001071	10,802	5	0.000463	0.000477
20	15,528	13	0.000837	0.001101	12,764	2	0.000157	0.000479
21	17,841	16	0.000897	0.001108	13,366	6	0.000449	0.000467
22	21,282	15	0.000705	0.001095	15,001	2	0.000133	0.000446
23	24,919	18	0.000722	0.001067	18,207	5	0.000275	0.000421
24	29,252	37	0.001265	0.001028	22,294	7	0.000314	0.000395
25	34,341	25	0.000728	0.000981	26,743	4	0.000150	0.000373
26	39,987	23	0.000575	0.000932	31,403	15	0.000478	0.000356
27	45,348	27	0.000595	0.000882	35,984	5	0.000139	0.000346
28	50,215	40	0.000797	0.000836	40,448	11	0.000272	0.000342
29	54,096	39	0.000721	0.000794	43,888	16	0.000365	0.000346
30	56,994	40	0.000702	0.000759	46,399	7	0.000151	0.000356
31	59,067	23	0.000389	0.000733	48,334	12	0.000248	0.000373
32	61,724	40	0.000648	0.000715	50,038	18	0.000360	0.000395
33	65,380	25	0.000382	0.000706	52,067	15	0.000288	0.000423
34	70,139	44	0.000627	0.000708	54,599	26	0.000476	0.000457
35	76,052	40	0.000526	0.000721	57,911	27	0.000466	0.000496

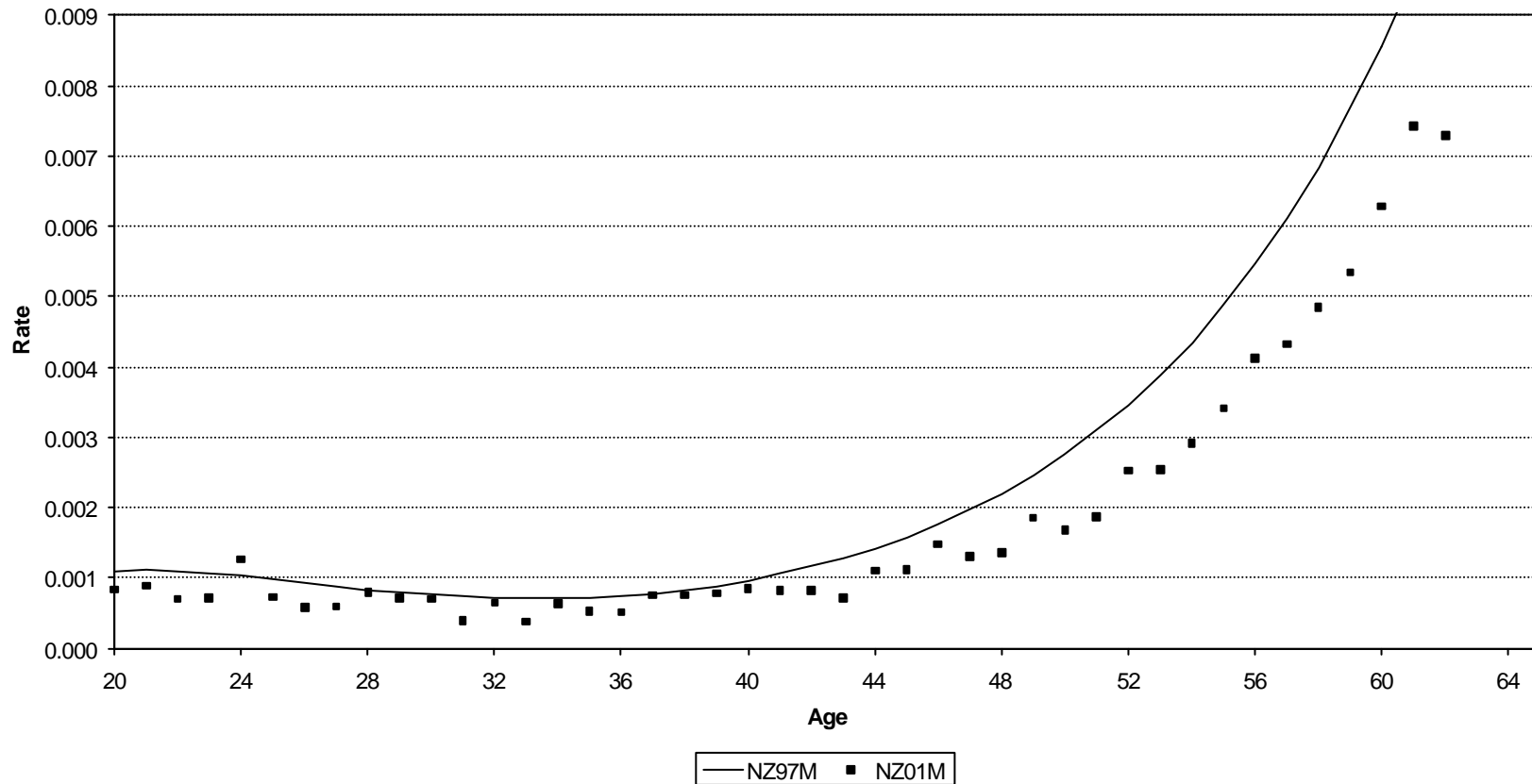
Age	NZ01M			NZ97M	NZ01F			NZ97F
	E_x	θ_x	q_x	\bar{q}_x	E_x	θ_x	q_x	\bar{q}_x
36	82,680	43	0.000520	0.000745	61,373	36	0.000587	0.000541
37	88,627	67	0.000756	0.000781	64,335	32	0.000497	0.000591
38	93,916	71	0.000756	0.000829	66,110	30	0.000454	0.000648
39	98,090	77	0.000785	0.000890	66,792	52	0.000779	0.000711
40	101,505	87	0.000857	0.000965	65,918	36	0.000546	0.000781
41	103,571	85	0.000821	0.001054	64,995	63	0.000969	0.000859
42	105,604	87	0.000824	0.001159	63,837	47	0.000736	0.000946
43	106,742	76	0.000712	0.001281	62,334	57	0.000914	0.001042
44	107,346	119	0.001109	0.001421	60,197	39	0.000648	0.001149
45	107,078	119	0.001111	0.001582	57,209	63	0.001101	0.001267
46	107,201	159	0.001483	0.001764	54,770	64	0.001169	0.001398
47	107,531	141	0.001311	0.001971	52,101	61	0.001171	0.001543
48	108,018	148	0.001370	0.002204	50,045	64	0.001279	0.001704
49	108,232	201	0.001857	0.002467	47,842	69	0.001442	0.001882
50	107,268	181	0.001687	0.002763	45,436	94	0.002069	0.002080
51	106,222	199	0.001873	0.003095	43,303	87	0.002009	0.002300
52	102,831	260	0.002528	0.003468	40,061	95	0.002371	0.002543
53	96,494	245	0.002539	0.003885	35,957	68	0.001891	0.002814
54	87,403	255	0.002918	0.004353	31,175	75	0.002406	0.003113
55	77,882	266	0.003415	0.004876	26,396	96	0.003637	0.003446
56	73,319	302	0.004119	0.005460	23,462	80	0.003410	0.003816
57	70,751	306	0.004325	0.006113	21,325	64	0.003001	0.004226
58	67,538	328	0.004857	0.006842	19,677	80	0.004066	0.004682
59	60,171	322	0.005351	0.007656	17,107	68	0.003975	0.005188
60	46,149	290	0.006284	0.008564	13,278	52	0.003916	0.005750
61	39,010	290	0.007434	0.009575	11,030	58	0.005258	0.006374
62	34,169	249	0.007287	0.010702	9,222	45	0.004880	0.007068
63	30,498	304	0.009968	0.011957	7,943	56	0.007051	0.007838
64	25,776	270	0.010475	0.013354	6,818	37	0.005427	0.008694
65	19,237	230	0.011956	0.014908	5,728	53	0.009253	0.009646
66	17,641	205	0.011621	0.016635	5,309	46	0.008665	0.010703
67	16,844	268	0.015911	0.018553	5,031	59	0.011727	0.011877
68	16,399	238	0.014514	0.020683	4,713	59	0.012520	0.013182
69	16,026	313	0.019531	0.023046	4,357	74	0.016986	0.014632
70	15,291	325	0.021254	0.025666	4,005	66	0.016479	0.016242
71	14,752	357	0.024201	0.028567	3,694	56	0.015160	0.018031
72	14,206	373	0.026257	0.031779	3,503	69	0.019700	0.020017
73	13,574	397	0.029247	0.035330	3,296	63	0.019117	0.022222
74	12,958	380	0.029326	0.039252	3,034	75	0.024720	0.024670
75	12,150	441	0.036298	0.043580	2,812	53	0.018848	0.027386

Age	NZ01M			NZ97M	NZ01F			NZ97F
	E_x	θ_x	q_x	\tilde{q}_x	E_x	θ_x	q_x	\tilde{q}_x
76	11,314	498	0.044016	0.048351	2,538	60	0.023641	0.030398
77	10,378	447	0.043072	0.053604	2,322	58	0.024984	0.033738
78	9,370	547	0.058378	0.059378	2,111	46	0.021791	0.037438
79	8,186	541	0.066088	0.065718	1,827	61	0.033388	0.041535
80	7,035	399	0.056716	0.072667	1,528	52	0.034031	0.046068
81	6,202	429	0.069171	0.080272	1,215	52	0.042816	0.051080
82	5,675	428	0.075425	0.088579	937	45	0.048026	0.056616
83	5,161	433	0.083907	0.097636	735	51	0.069435	0.062725
84	4,698	350	0.074500	0.107490	593	37	0.062395	0.069458
85	4,147	413	0.099590	0.118186	505	41	0.081269	0.076869
86	3,632	419	0.115363	0.129770	452	24	0.053097	0.085014
87	3,028	307	0.101387	0.142280	434	34	0.078431	0.093951
88	2,500	346	0.138428	0.155755	382	38	0.099476	0.103739
89	1,955	313	0.160143	0.170225	327	22	0.067381	0.114439
90	1,454	255	0.175378	0.185715	286	29	0.101576	0.126108
91	1,132	193	0.170495	0.202239	239	25	0.104603	0.138803
92	942	151	0.160382	0.219805	206	26	0.126521	0.152578
93	772	160	0.207254	0.238406	163	12	0.073846	0.167481
94	488	78	0.160000	0.258026	143	10	0.070175	0.183552
95	89	6	0.067416	0.278634	19	1	0.052632	0.200822
96	41	8	0.195122	0.300183	8	0	0.000000	0.219313
97	30	1	0.033333	0.322615	5	0	0.000000	0.239030
98	26	1	0.039216	0.345855	3	1	0.400000	0.259964
99	22	2	0.090909	0.369815	1	0	0.000000	0.282088
100	11	0	0.000000	0.394393	1	0	0.000000	0.305356

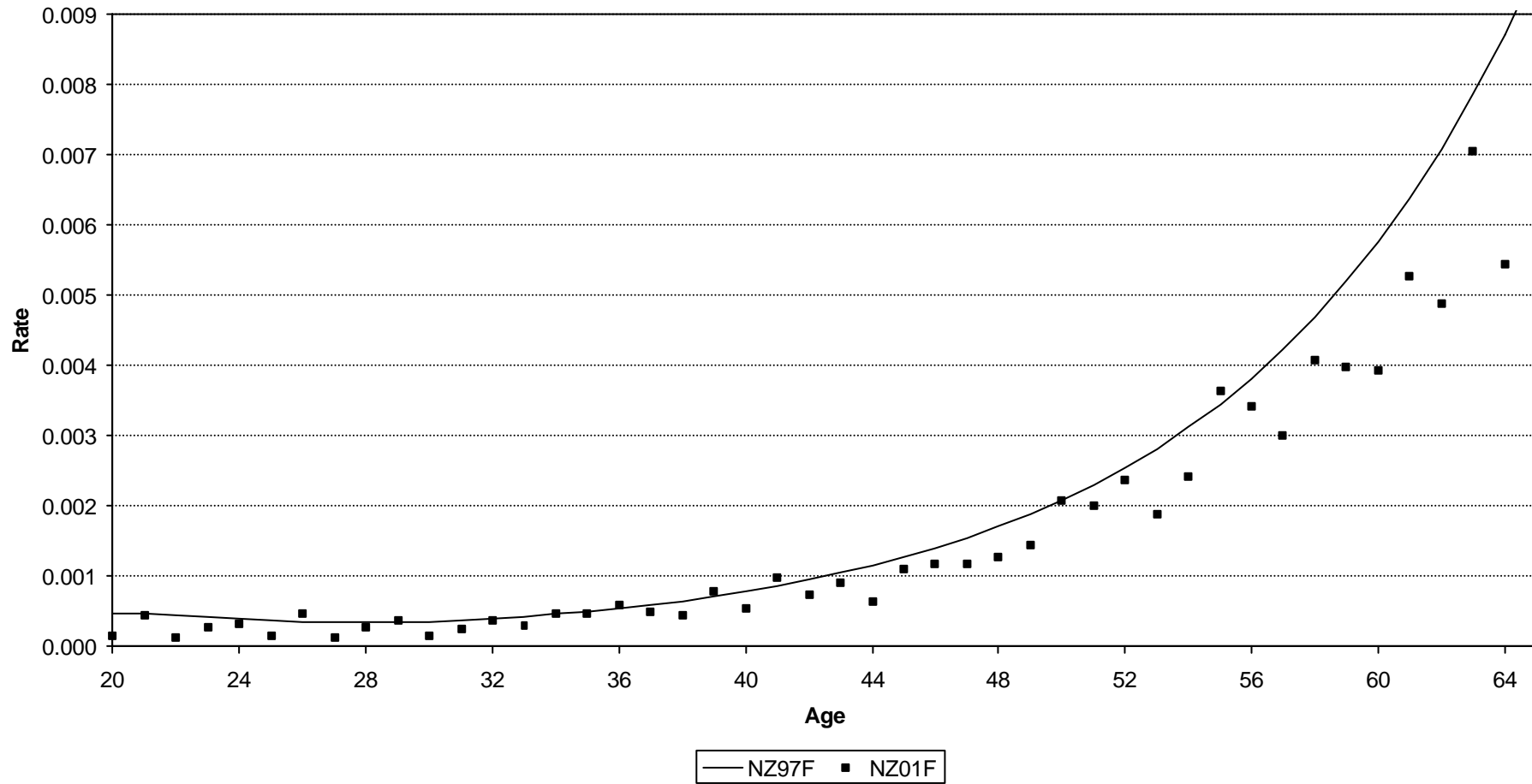
The data at certain ages in this investigation is limited. This was also the case for the data on which the 97 graduated rates shown were based. It would be inappropriate to place too much reliance on values at the tail ends of the table. Care needs to be applied in the interpretation and use of these mortality rates.

7. Graphs of 2001 aggregate results

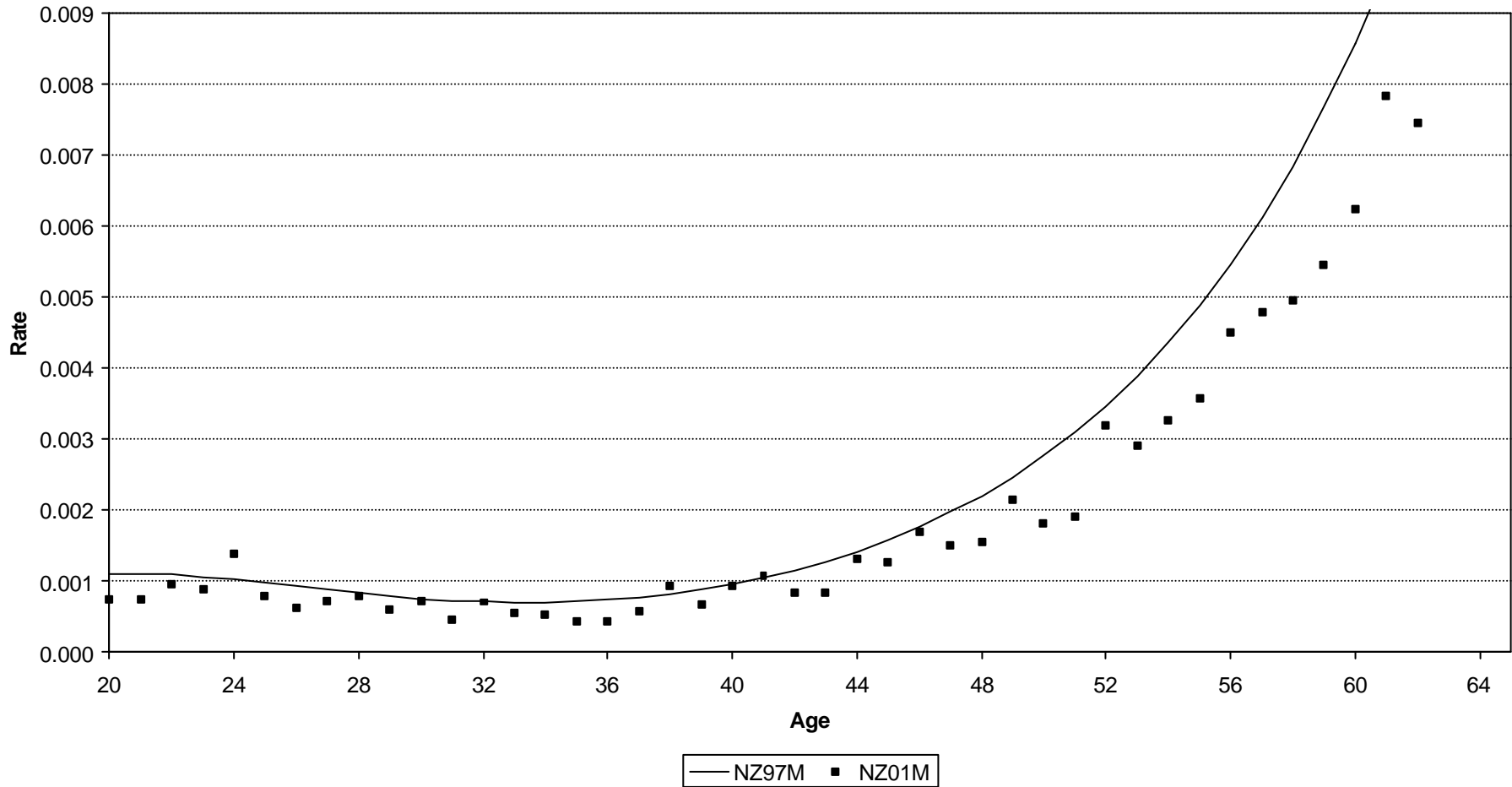
Comparison between NZ01M and NZ97M
Aggregate
Ages 20 - 65



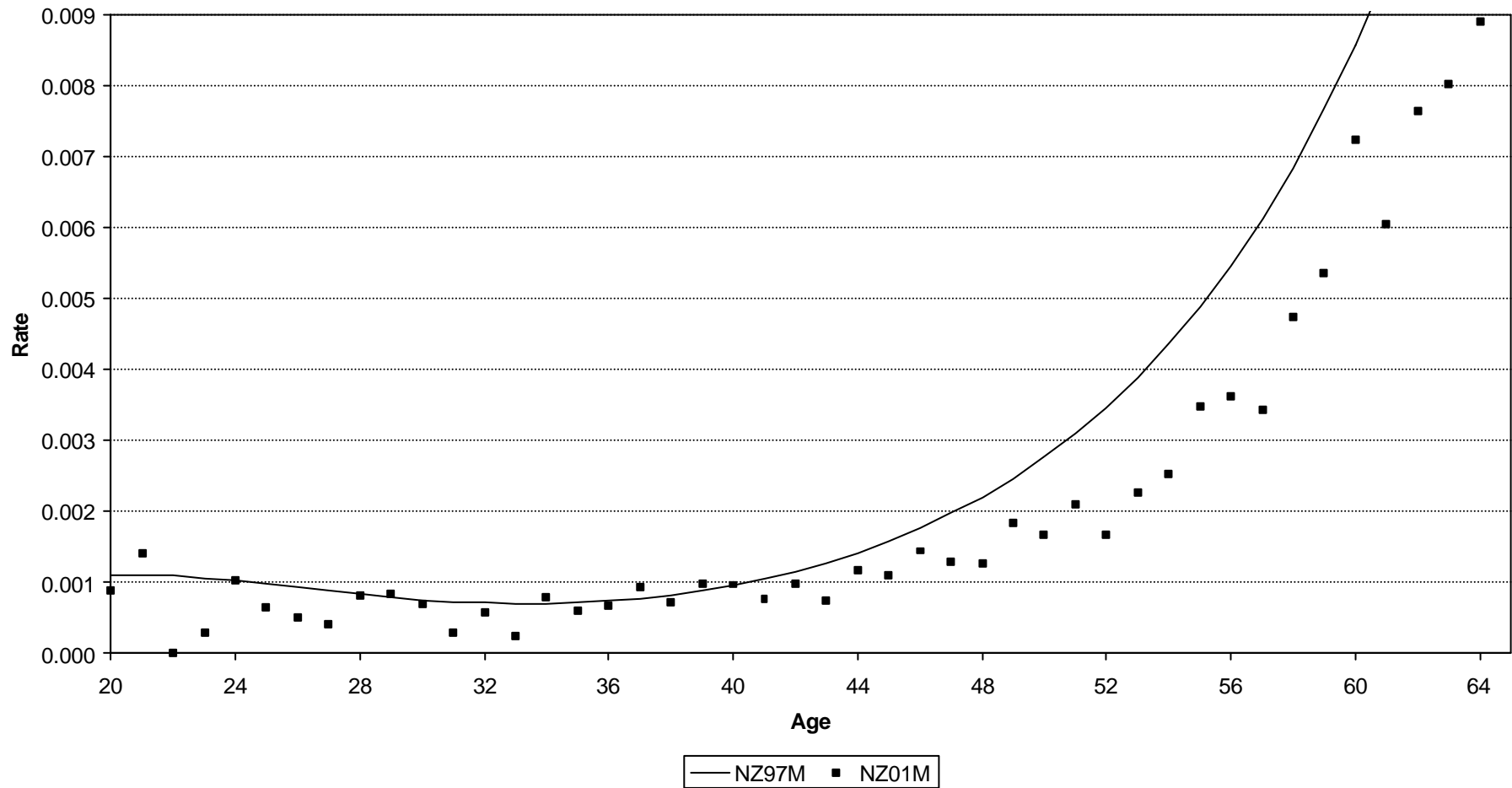
**Comparison between NZ01F and NZ97F
Aggregate
Ages 20 - 65**



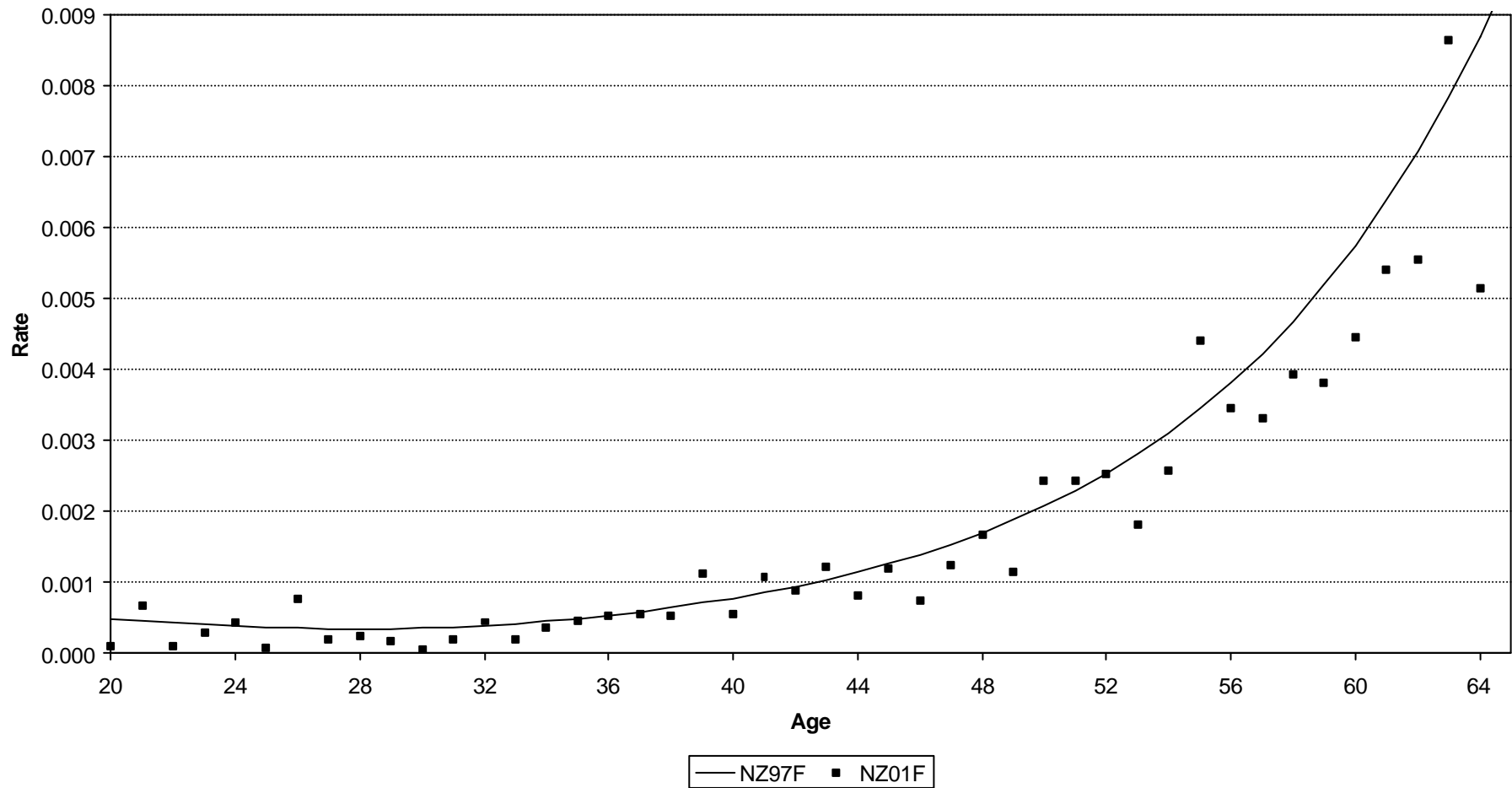
**Comparison between NZ01M and NZ97M
Aggregate - Policy Type (a)
Ages 20 - 65**



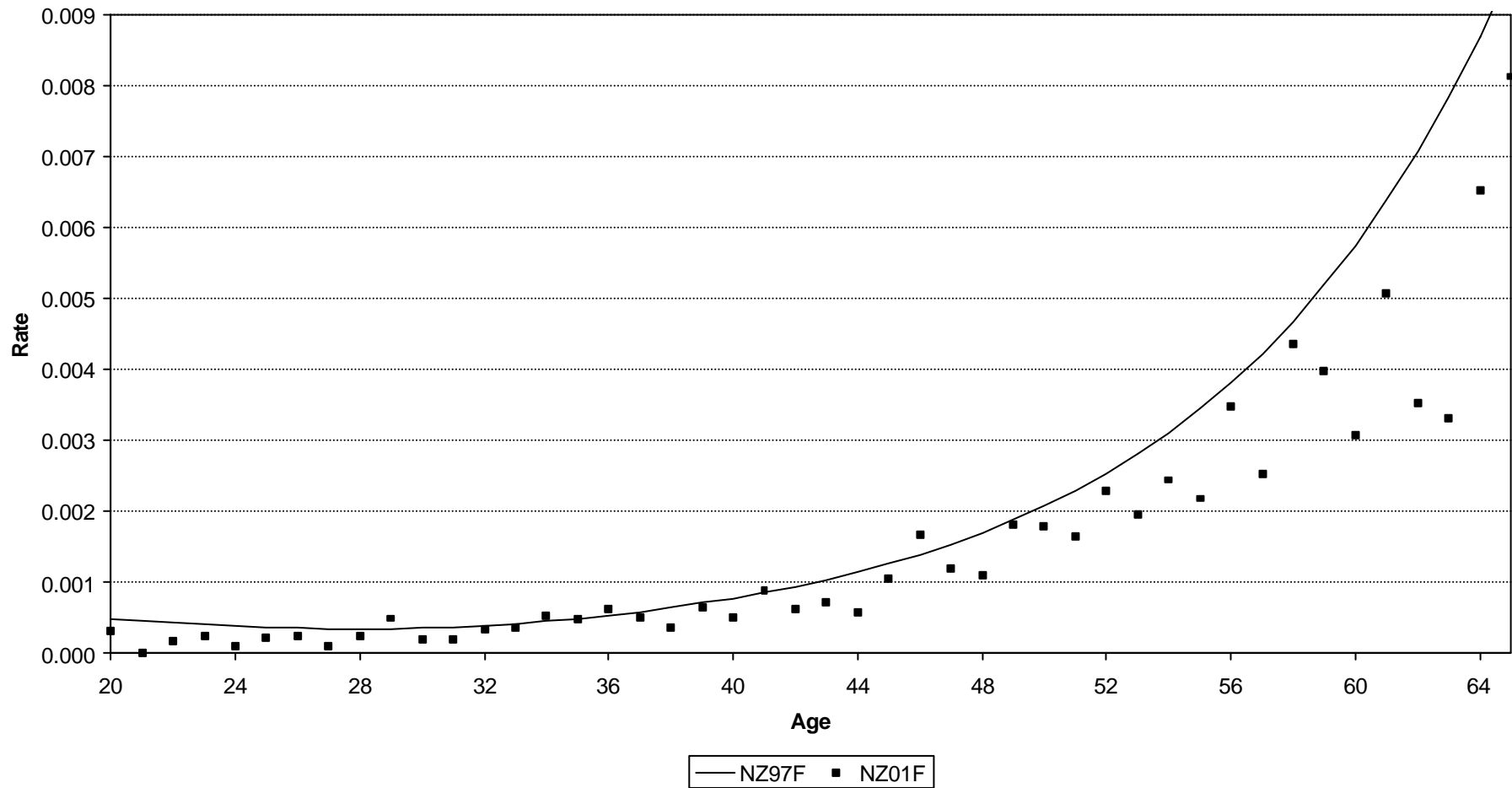
**Comparison between NZ01M and NZ97M
Aggregate - Policy Type (b)
Ages 20 - 65**

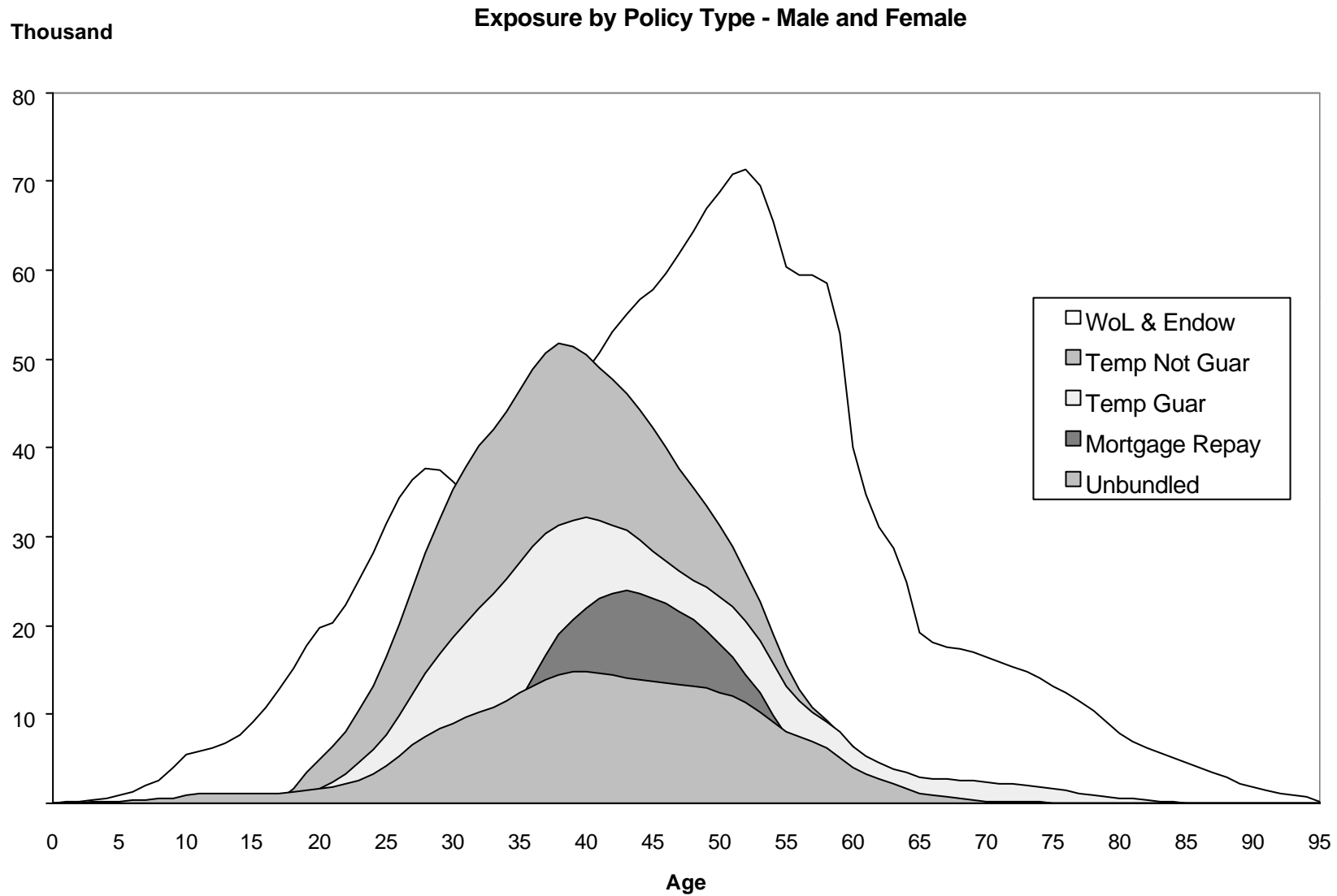


Comparison between NZ01F and NZ97F
Aggregate - Policy Type (a)
Ages 20 - 65



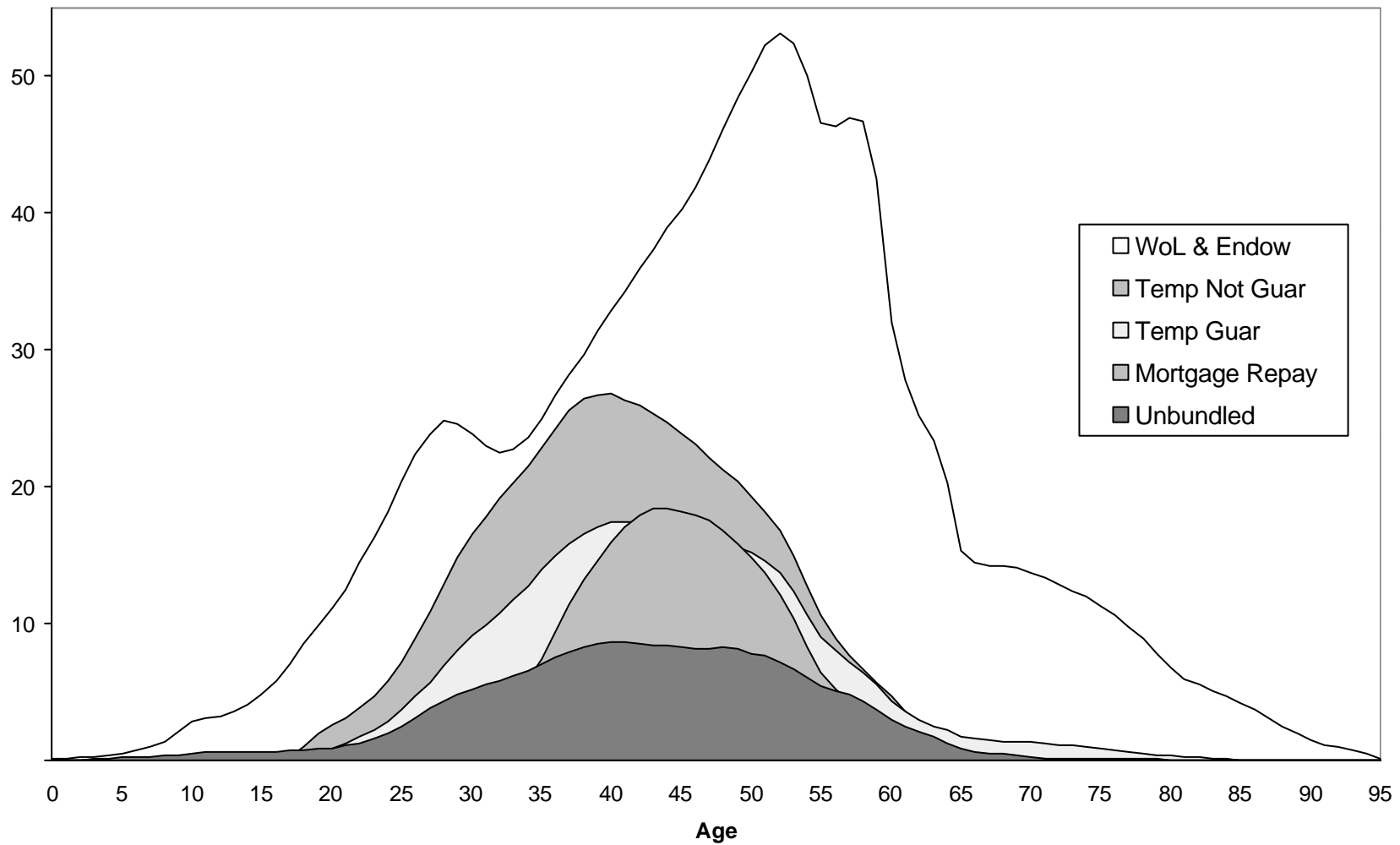
**Comparison between NZ01F and NZ97F
Aggregate - Policy Type (b)
Ages 20 - 65**

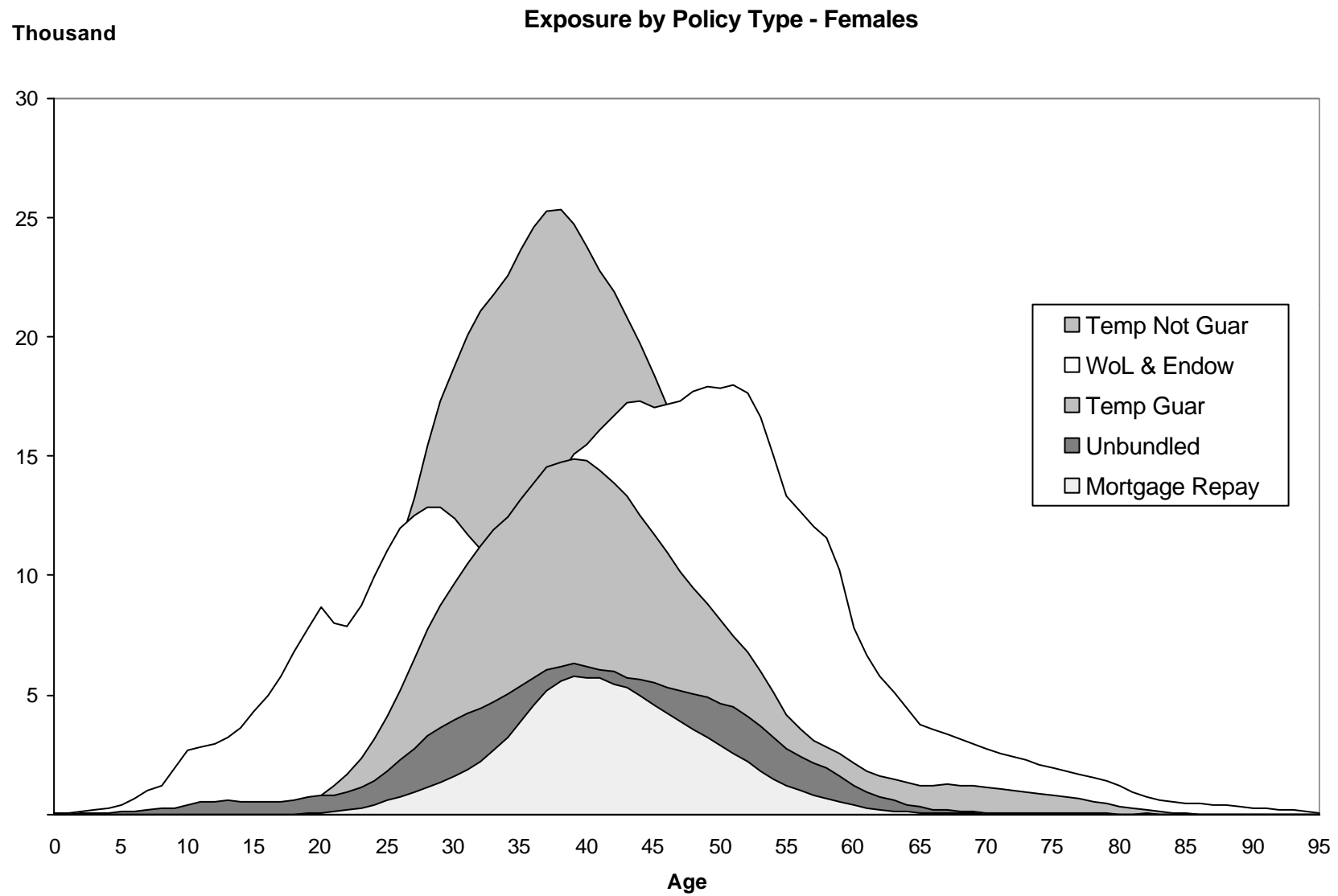




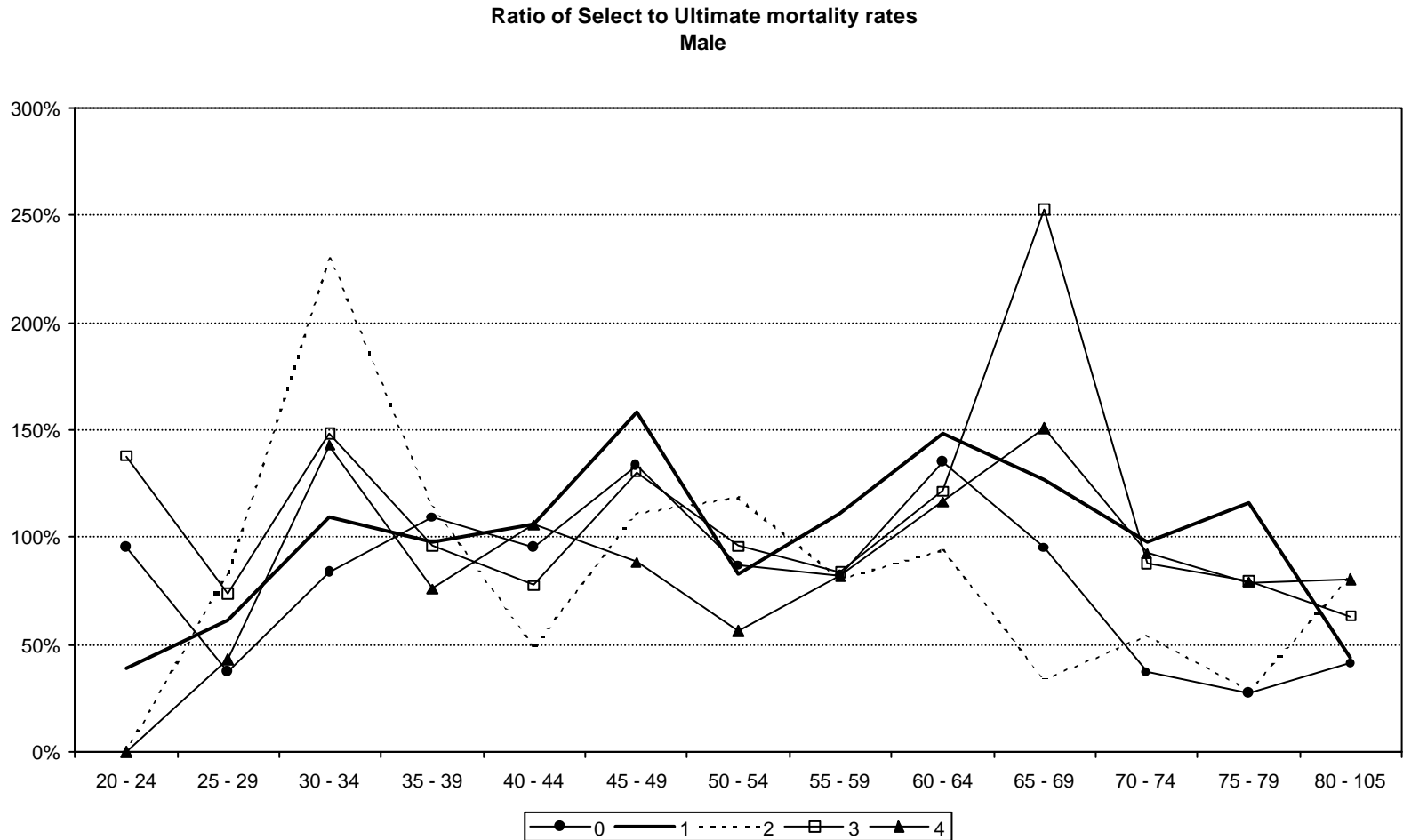
Thousand

Exposure by Policy Type - Males

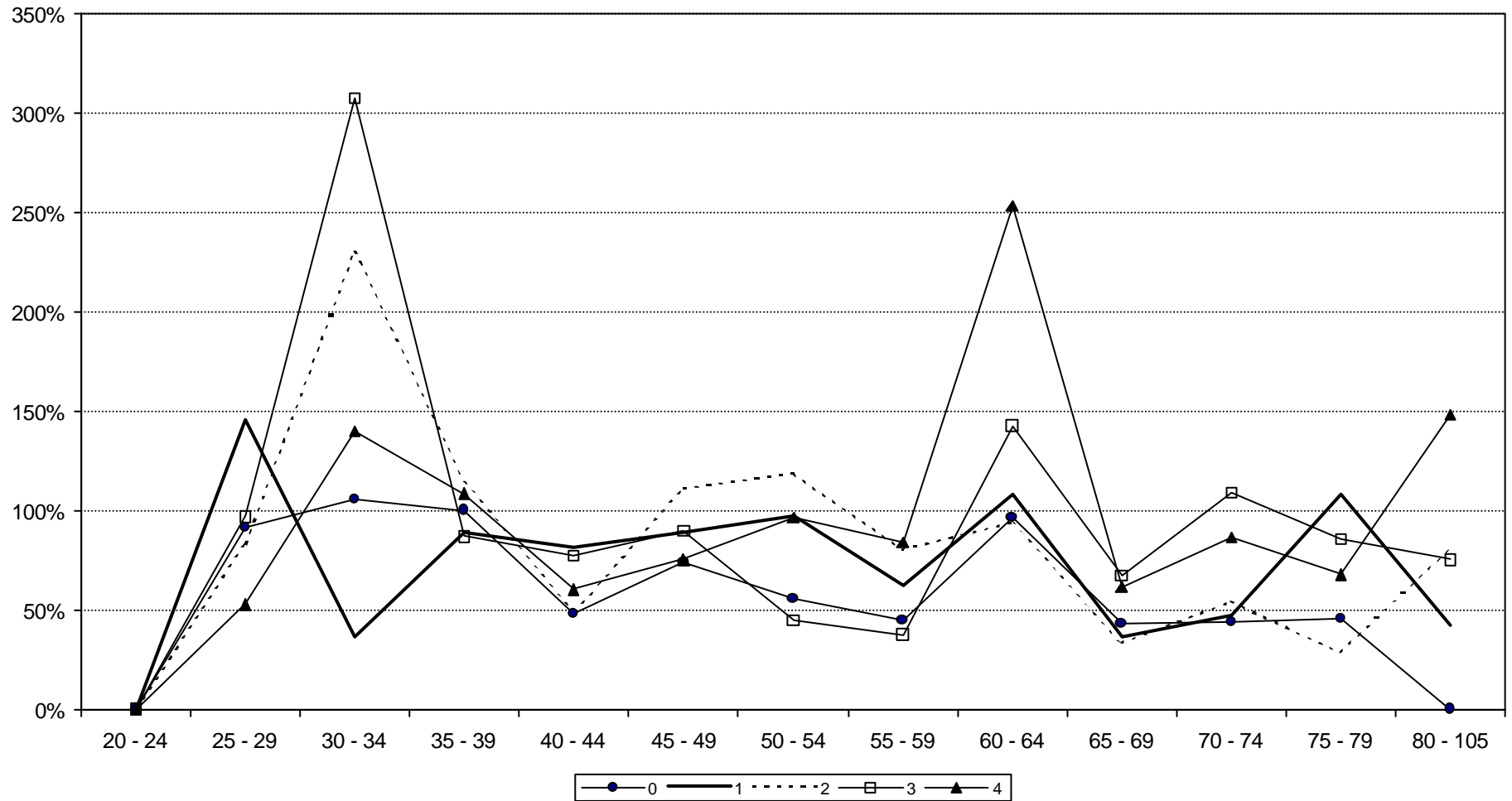




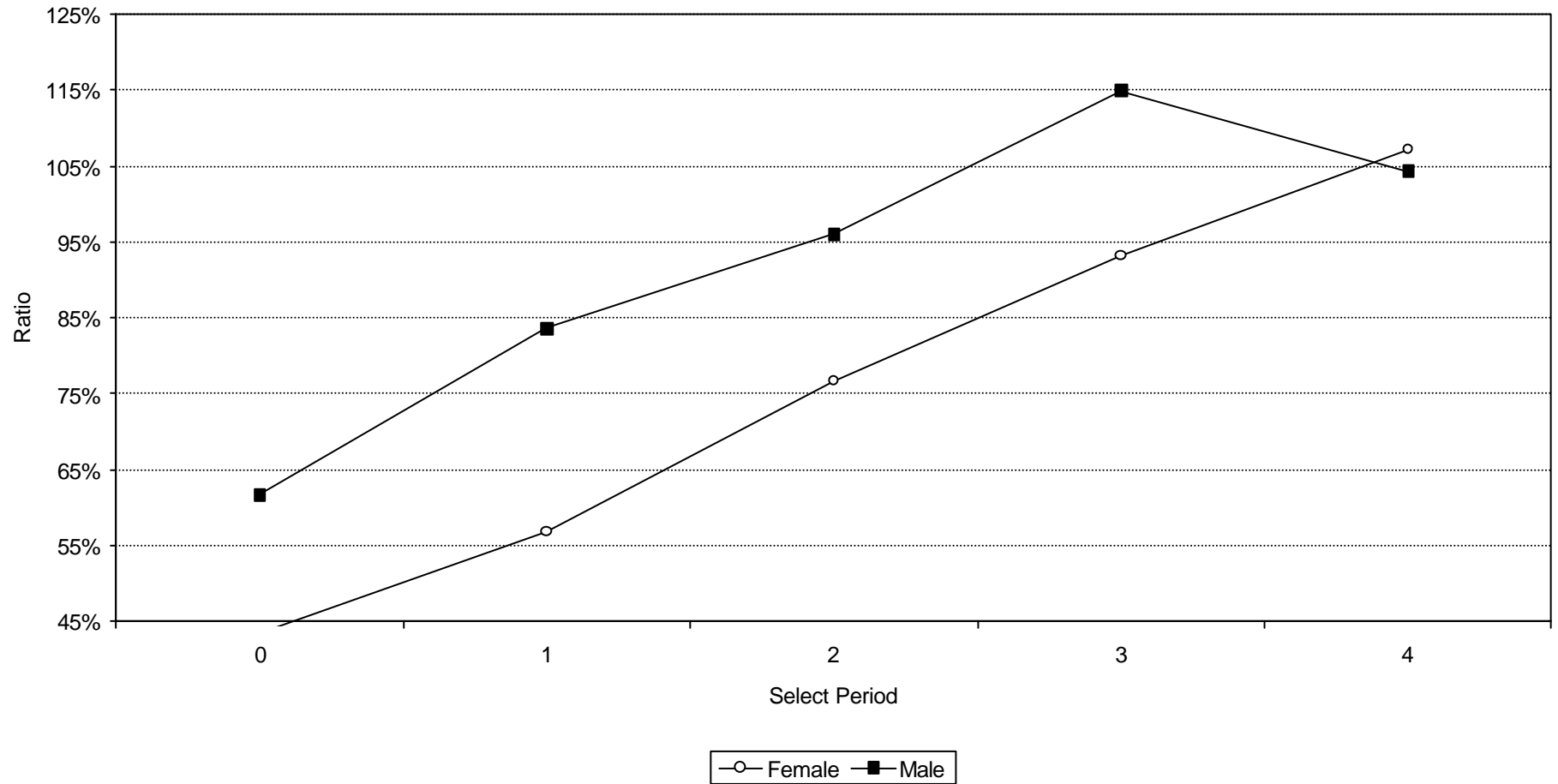
8. 2001 select results for policy type (b)



Ratio of Select to Ultimate mortality rates Female



**Ratio of Select to Ultimate mortality rates
Ages 0 - 105 (combined)
Male and Female**



**Ratio of Select to Ultimate mortality rates
Ages 25 - 50 (combined)
Male and Female**

