Institute
and Faculty
of Actuaries

Periodical Payment Orders Working Party Update

2015 Update Report

by the Periodical Payment Orders Working Party

Public Report

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Disclaimer

Executive summary

One key unfolding situation that will influence whether the experience is a trend is the ongoing discount rate consultation. This will define the future real discount rate for lump sum settlements and hence PPO propensity due to their relative economic values driving attractiveness. The most recent development is the appointment of the three experts as the panel of advisors to the government. They have a mandate to report back within six months.

The impact of Inflation on PPO propensity should not be ignored. The 80th percentile of ASHE 6115 was only slightly above zero, following two years' of negative inflation. This may impact on the attractiveness of PPOs for claimants and the subsequent propensity of PPOs.

We have some valuable information on mortality, following analysis of data from New Zealand, which adds to the work previously done on Australia. Our high level findings were consistent between both the Australian and New Zealand analyses, for example we found again that spinal injuries have higher mortality rates than brain injuries, and that severity of injury is significant to mortality outcomes. The latter point is particularly interesting given that not all companies in the UK currently record the severity of brain injuries. The working party has this year published injury categorisations that we strongly encourage the industry to adopt going forward.

Lastly and most importantly, thanks to all the working party members. Not just for volunteering their time but also contributing to the vibrant and energetic discussions. Without them we would not be able to produce what we do. So thanks to them, and to their companies for allowing them to provide such valuable input. Particular thanks must go to associates at Towers Watson who perform analysis of the data, especially Patrick Tingay.

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Discount Rate Consultation

The Lord Chancellor announced in 2010 that the Ministry of Justice (MoJ) would be considering reducing the real discount rate used in calculating lump sum bodily injury awards from the 2.5% currently used, to reflect the lower investment returns available in the current economic environment. This would increase the cost of those awards. Various deadlines have arrived without announcement. However, the MoJ have conducted two consultations.

The first consultation[1], which ran from 1 August 2012 to 23 October 2012 was concerned with how the discount rate should be set. This has led to discussions around a wide range of topics including, more notably, whether the discount rate should be based on the actual returns achieved by investors and what that assumption might be - a notional risk free rate, a rate based on a heavy GILT weighted portfolio, or a return based on a risk seeking investor.

The second consultation[2], which ran from 12 February 2013 to 7 May 2013 was concerned with the legal framework. This has been interpreted by some as giving the impression that the view of the MoJ was that PPOs were beneficial to society and invited respondents to answer questions, such as:

- Do you consider that the present level of usage of periodical payments is appropriate and that no change is necessary?
- if not, please indicate the measures that you think should be taken to increase their use.

This has led to some within the industry to suggest that there is some appetite to increase the Ogden discount rate.

Additionally, if rates were reduced, the Government would have to find the money to fund the increases on their own bodily injury claims.

In September 2014, the MoJ put out a tender[3] for expert advice on setting the discount rate. In March 2015 the announcement of the panel members who will advise the MOJ on the setting of the discount rate was made.

The expert panel will provide advice about the investments that claimants in personal injury cases should be assumed to make with their lump sum damages for future pecuniary loss and the expected yields from those investments. In the light of that, the panel will advise the Lord Chancellor and his counterparts in the devolved administrations what the discount rate should be and how it should be calculated. They have six months to complete the work.

The experts appointed were:

- Dr John Pollock of Pollock and Galbraith, Actuaries
- Mr Richard Cropper of Personal Financial Planning (PFP) Ltd
- Dr Paul Cox of the Department of Finance, University of Birmingham

[1] https://consult.justice.gov.uk/digital-communications/discount-rate

[2] https://consult.justice.gov.uk/digital-communications/damages-act-1996-the-discount-rate-review-of-the

[3] https://online.contractsfinder.businesslink.gov.uk/Common/View%20Notice.aspx?site=1000&lang=en&NoticeId=1510461
Or http://www.publictenders.net/node/2721299

Injury Categorisations

The PPO Working Party has devised a categorisation of PPO injuries with the intention of this becoming UK standard practice, used by all (re)insurers. The benefits of using this would be to enhance valuation of PPOs, aid in negotiations and improve future PPO propensity projections.

Seventy percent of PPOs relate to brain injuries and twenty percent to spinal injuries, and with PPO liabilities now remaining on balance sheets for decades, the impact of mortality on these liabilities is significant. We know that there are more PPOs from claimants with a brain injury than for a spinal injury, but we do not see statistics of whether this is caused by more large claims being caused by brain injuries or that a brain injury is more likely to settle as a PPO. It seems reasonable to assume that part of the difference would be caused by the requirement that claimants with a brain injury have their settlement package authorised by a judge. We see that the severity of injury has a large impact on the mortality outcome and the size of the claim but to date we have not had a standard way of capturing this, particularly for brain injuries.

Background

Rather than devising something unworkable ourselves, we decided to enlist the help of some claims professionals. They will likely be the people populating the data, whether into a system or database. Thus they are in the best position to identify what is most appropriate.

Previously most categorisation systems were derived by looking at severity of injury suffered. The experts we consulted highlighted that there was another factor influencing the size of a claim.

The additional piece of information needed was the amount of care an injured person needs. The additional care regime information below has, therefore, been added under the advice gained from those claims professionals the working party consulted: for example, someone who has a brain injury may need round the clock care due to their inhibitions having gone, but they may be classified as the lowest form of brain injury, ‘No mobility issues’.

Changes desired

- Categorisations to be recorded for all brain, spinal or amputation large claims (not just PPOs) – where large is defined as >£1 million in 2011 terms, based on 7% annual inflation and assuming the claim is reserved based on Ogden 2.5% assumption with only the latest assessment to be entered on the submission file from claims. It should always be the latest assessment, independent of whether the claim is unsettled, or has settled as a PPO and is in payment.
- A field showing the latest date at which these codes have been updated/entered to be recorded (hopefully a history of files saved at different times would then be available to the actuaries to analyse changes in definitions over time).
- These categorisations to be retrospective back to claims settled since 2008.

Benefits of changing

We will be looking to collect this data and if this is available across the market, we would be able to:

- provide benchmarks for PPO propensity by type of injury and also by the severity of the injury.
- Track mortality in much greater detail, aiding valuations of reserving, capital and pricing and providing an additional consideration in the settlement of lump sums.

A table of the categorisation descriptions is shown below.

Injury type	Code	Category	Description
Brain	B1	PVS	Permanent Vegetative State – No purposeful motor or cognitive function. Requires a feeding tube.
	B2	Cannot walk - Fed by others	Does not feed self, must be fed completely (either orally or by a feeding tube)
	B3	Cannot walk - Self feeds	Can feed self with fingers or utensils, with assistance and/or spillage
	B4	Some walking ability	Walks with support, or unsteadily alone at least 10 feet but does not balance well
	B5	Walks well alone	for at least 20 feet, and balances well
	B6	No mobility issues	
Spinal	S1	Tetraplegia Ventilator Dependent	C1-C3
	S2	High level Tetraplegia	C4-C5
	S3	Low level tetraplegia	C6-C7
	S4	High level Paraplegia	Thoracic T1-T12
	S5	Low level paraplegia	Lumbar
	Complete/ incomplete flag	Complete or incomplete selected	
Amputation	A1	Double upper limb	Double upper limb amputation (or loss of use), including bilateral brachial plexus injuries etc
	A2	Leg - above knee	
	A3	Leg - below knee	
	A4	Other Amputation	
Other	O1		
Care regime			
	C1	24/7 2 or more care ratio	24 hour care needing two or more carers for all that time
	C2	24/7 1-2 care ratio	24 hour care needing one to two carers for all that time
	C3	24/7 but night sleeper	24 hour care with at least one carer but carers can sleep at night
	C4	9 or more hours duty care a day	
	C5	5 to 8 hours duty care a day	
	C6	0 to 4 hours duty care a day	
	C7	Domestic help only, no personal care	

For more information and a sample spreadsheet showing how these categorisations could be applied in practice please see the working parties page on the institute website. At the time of printing, http://www.actuaries.org.uk/practice-areas/pages/ppos.

Impaired life investigations

Introduction

PPOs have only been settling in the UK in any number since 2008. As a result the settled PPO population provides a limited amount of data on which to base any mortality investigations. Around 70% of PPOs involve brain injuries and around 20% spinal injuries, each with varying degrees of seriousness. Over the years the working party has been gathering data and information from around the world to increase our understanding of mortality of individuals with injuries such as these.

The following sets out the mortality work the working party has reported on in previous papers:

- 2010 - Discussion of impaired mortality adjustments as used in the life industry.

- 2012 - A summary of the McMillan paper which looked at mortality after head injury, based on a small sample of 757 patients who were followed over a 15 year period. Also a discussion of sources of UK mortality data that are available.

- 2013 - Results of an investigation into impaired mortality for brain and spinal injuries based on New Zealand data.

Copies of these previous papers can be downloaded from the PPO working party page on the Institute and Faculty of Actuaries website: http://www.actuaries.org.uk/practice-areas/pages/ppos

This year we have analysed data from the State of Victoria in Australia. We have also compared these results to our findings based on New Zealand experience from last year. The results of our investigation are presented in this section of the paper.

Injury categorisations

Analyses such as those we have carried out on the New Zealand and Australian data are more difficult on UK data, largely due to the lack of history of data as discussed above, but also as the severity of injury for brain injuries is generally not recorded in the UK. The working party has this year published injury categorisations that we encourage the industry to adopt as this will facilitate improved data analysis in the future. The recommended categorisations are set out in the Injury Categorisation section of this paper and can also be found on the PPO working party page on the Institute and Faculty of Actuaries' website.

Australia road traffic accident mortality experience

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1. Executive summary

1.1. The State of Victoria in Australia has been settling all bodily injury claims which are as a result of transport accidents since 1987. This gives us data relating to claims that have happened up to almost three decades ago. However, we have been informed that the injury codes are not reliable before 2008, so our analysis, whilst it covers claims that have occurred since 1987, covers exposure periods from 2008 to June 2013.

1.2. Whilst we have a significantly larger body of data than is available based on UK PPOs, this is still a small sample size upon which to base conclusions, and care should be taken not to place undue reliance upon the results. In addition, there are a number of features that affect the reliability and relevance of the data for assessing the mortality of UK PPO claimants (these are discussed in the Section 6 on Limitations). That said, our approach is to conclude that if we see the same high level trends or patterns repeated in various data analyses on brain and spinal injuries from around the world, then it is likely we can draw some high level conclusions.

1.3. The results are intended to be used in conjunction with knowledge of other similar studies and should not be relied upon in isolation. In particular, (re)insurers considering the findings contained in this paper should take into account how their own portfolio may differ from the population in this investigation, for example in terms of the age profile and injury severity of the claimants (particularly for reinsurers who may only provide cover for the larger PPO claims). We draw readers' attentions to Section 6 on Limitations.

1.4 In this study, we have compared our findings with those of our investigation from last year using New Zealand data (the write up of which can be found in the Working Party's 2013 paper). In particular, we discuss and demonstrate at various points in the results section how differences in the mix of exposure between the Australian and New Zealand data can lead to very different point estimates for mortality multipliers.

1.5 We are very grateful to TAC (the Transport Accident Commission) for making this data available to us.

High level conclusions

1.6 Our high level findings were similar to those drawn from the investigation we undertook last year on New Zealand data:

- Spinal injuries have higher mortality rates than brain injuries.
- Severity of injury is significant to mortality outcomes.
- Whilst there is not enough data to comment definitively on the shape of the mortality curve we do observe that:
  - If using a multiplier adjustment, this does appear to decrease by age and this effect is more pronounced the more severe the injury.
  - It appears that time since accident does not have a significant impact on mortality – however there is insufficient data available to allow us to draw a firm conclusion on this.

2. Background

2.1 TAC (the Transport Accident Commission) was set up in 1987 and benefits people who live in the State of Victoria. It provides compensation for bodily injury claims directly caused by the driving of a car, motorcycle, bus, train or tram. Since it is a no-fault scheme it pays benefits regardless of who caused the accident.

2.2 The scheme is funded by payments made by Victorian motorists when they register their vehicles each year with VicRoads. It pays on average AUS$150,000 for each road death and AUS$1,500,000 for each serious injury. As well as medical costs, the TAC can pay income support, travel and household support benefits. The property damage element of claims lies outside the scheme and is covered by private insurers.

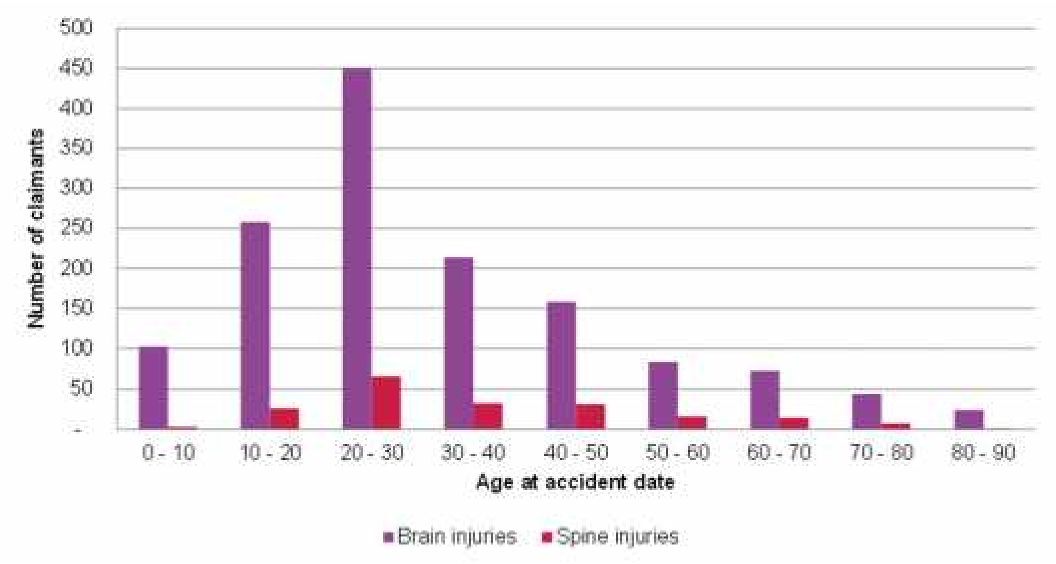
2.3 In addition to providing financial support to those who have been injured, TAC aims to increase awareness of road safety issues, change behaviour and ultimately reduce the occurrence of road traffic accidents.

3. Data

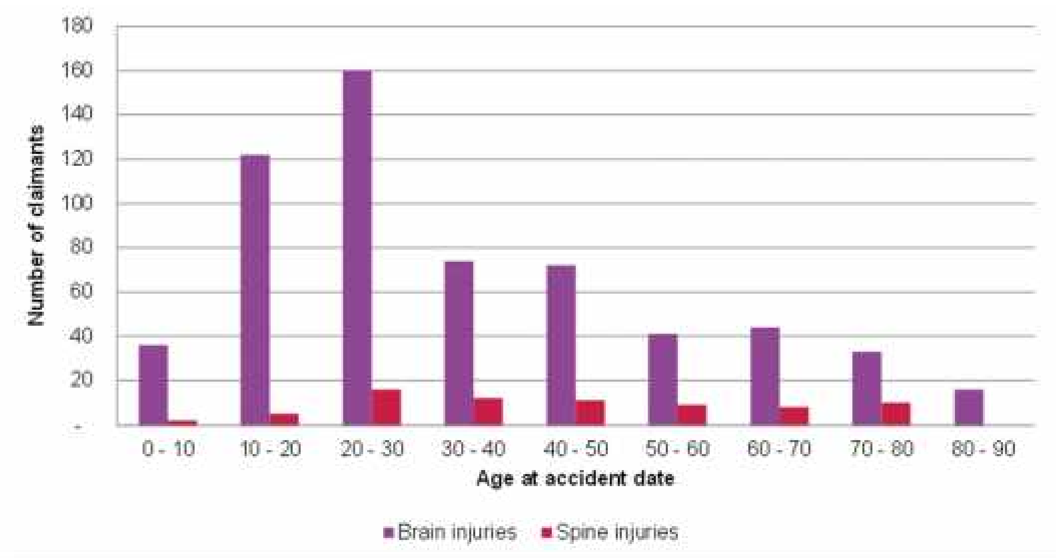
3.1 The investigation period used is 1 January 2008 to 30 June 2013. Whilst the TAC scheme has been running since 1987, we have been told that prior to 2008 injury codes are not reliable. This is because TAC have changed their injury codes a number of times in the past. Therefore, although the data includes accidents prior to 1987, our analysis only covers exposure periods from 2008 onwards.

3.2 The data has been used to investigate serious brain and spinal injury mortality experience. There are 2,416 claimants included in the investigation, of whom 1,688 are male and 728 are female. These contribute a total of 11,200 years of exposure over the investigation period, 7,750 years of which is male exposure.

Distribution of male claimants by age at accident



Distribution of female claimants by age at accident



3.3 The data for each claimant includes:

- Year of birth;
- Gender;
- Year of accident;
- Year of death (where applicable); and
- Injury type.

3.4 We were not provided with the exact date of birth of claimants or their date of death, only the year. These years run from 1 July to 30 June. A reference to 2013 means the period from 1 July 2012 to 30 June 2013. We made the assumption that births and deaths occur on average in the middle of the year, and so have assumed that all births and deaths occurred on 1 January.

Injury definitions

3.5 The following injury types, which were considered to be most relevant to PPO claimants, were included in the mortality investigation:

- Brain
  - Severe brain injury; and
  - Moderate brain injury.
- Spinal
  - High level tetraplegia;
  - Low level tetraplegia; and
  - Paraplegia.

3.6 The injury classifications provided by TAC are different from those used by the New Zealand Accident Compensation Corporation (ACC). We have mapped the TAC categories to those used by the ACC, under guidance from TAC, in order to make our analyses comparable. However, it is not possible to map the two injury classifications with complete accuracy. Details of the mapping table are given in appendix A.

4. Comparison by territory

4.1 We have looked at data from Australia and New Zealand to supplement our understanding of mortality experience for brain and spinal injuries in the UK. Whilst there are differences in the territories, which mean that direct comparisons are difficult to make with complete accuracy, we believe there are sufficient similarities to enable us to draw some broad conclusions. We have limited data in the UK; so it makes sense to look for trends observed elsewhere in the world – if we repeatedly see a trend then we may be able to draw some conclusions. We are however unlikely to ever have an exact answer to the shape and level of the brain and spinal injury mortality curves. The reasons for this are covered in the limitations section 6 below.

4.2 The following table summarises the main features of the New Zealand and Victorian state systems that have been set up to cover bodily injury claims from road traffic accidents.

	Victoria	New Zealand
Started	1987	1974
Cover	Transport accidents directly caused by the driving of a car, motorcycle, bus, train or tram	All bodily injury accident claims in New Zealand – Only motor included in our study
Exposure	Since 2008 only – Prior to 2008 injury codes are not reliable	Since 1999 only - Claimants with accident dates pre 1999 will only be those that were still alive in 1999

4.3 The following table provides a comparison of 2013 road traffic accident statistics between the three territories:

	UK	NZ	Victoria
Population (millions)	64.1	4.5	5.8
Vehicles on road (millions)	35.2	3.3	4.4
Vehicles per head of population	0.55	0.74	0.76
Annual deaths	1,785	254	255
Annual injuries	185,540	11,781	N/A
Deaths per 100,000 population	2.78	5.67	4.40
Injuries per 100,000 population	289	263	N/A
Deaths per 10,000 vehicles	0.51	0.77	0.55
Injuries per 10,000 vehicles	527	356	N/A

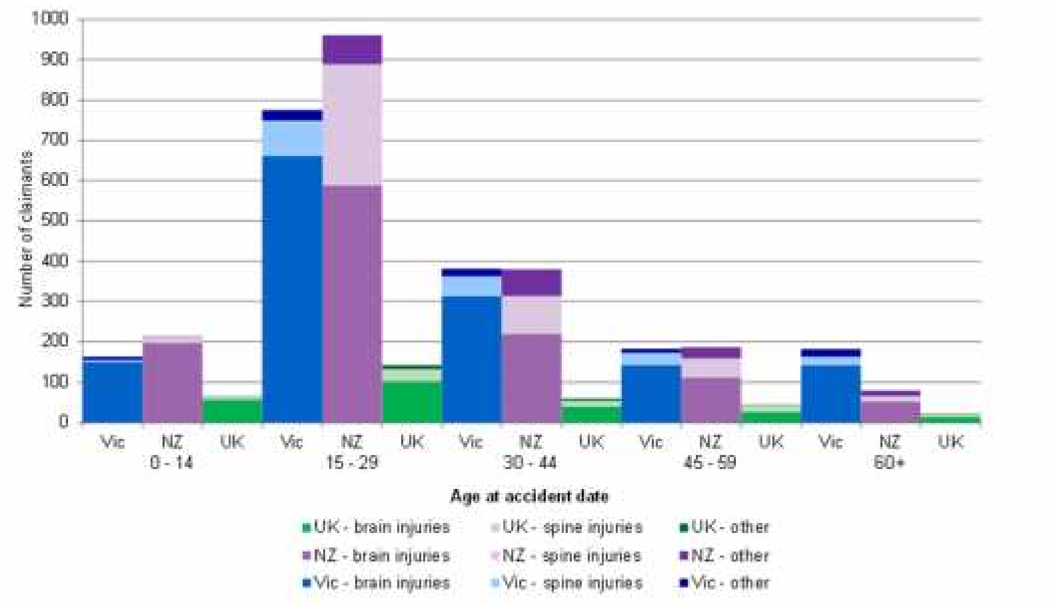
4.4 Whilst New Zealand and Victoria, Australia have a comparable land mass to the UK, they have less than 10% of the population. In New Zealand and Victoria the ratio of cars to people is more than a third higher than it is in the UK.

4.5 The mortality rate from road traffic accidents is significantly higher in New Zealand and Victoria than the UK, at 2.0 and 1.6 times respectively, however the New Zealand injury rates are comparable per head of population (we could not find comparable figures for Victoria).

4.5 The following graph highlights just how much less data is available on PPOs in the UK, which are shown in green on the graph. This is for a number of reasons:

- The primary reason is as PPOs have only been settled since 2008, whereas the data has been collected in Victoria and New Zealand for decades.
- The New Zealand and Victorian data includes all road traffic accident bodily injury claims, whereas the UK data only includes those claims that have settled as PPOs (only around a third of motor bodily injury claims above £1 million settle as a PPO).

Distribution of male claimants by injury type and age at accident



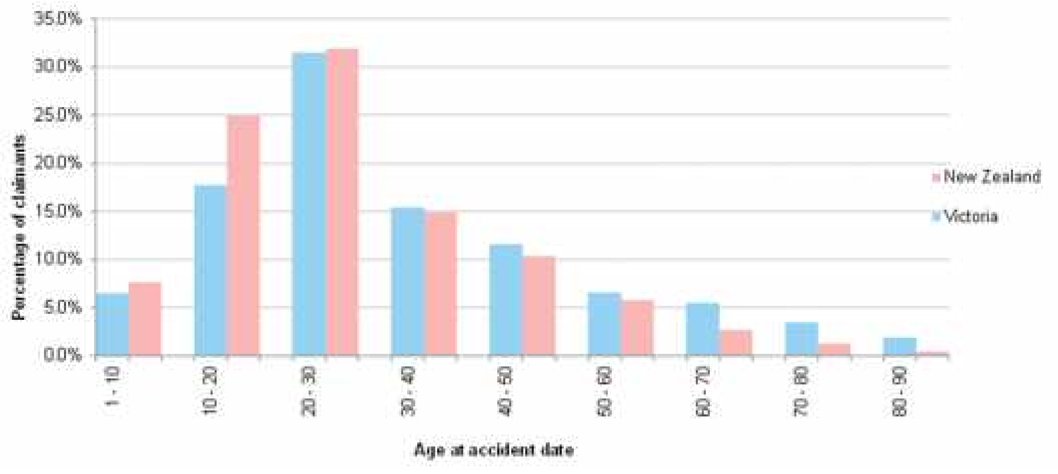
4.6 The relative proportions of injuries split by brain, spinal and other injuries are broadly comparable across all three territories as is the split by age at accident. There are however some notable differences between the territories:

- New Zealand has a higher proportion of spinal injuries than Victoria and the UK. The mix by injury severity also differs. In New Zealand, paraplegia claims make up over half of the total spinal injury claims, whereas in Victoria there are very few paraplegia claims.
- The majority of brain injury claims in both New Zealand and Victoria are of moderate severity but New Zealand has a higher proportion of claimants with severe brain injuries.

  We asked the providers of the data why there might be these two differences between the New Zealand and Victorian data, and they could not provide an explanation.

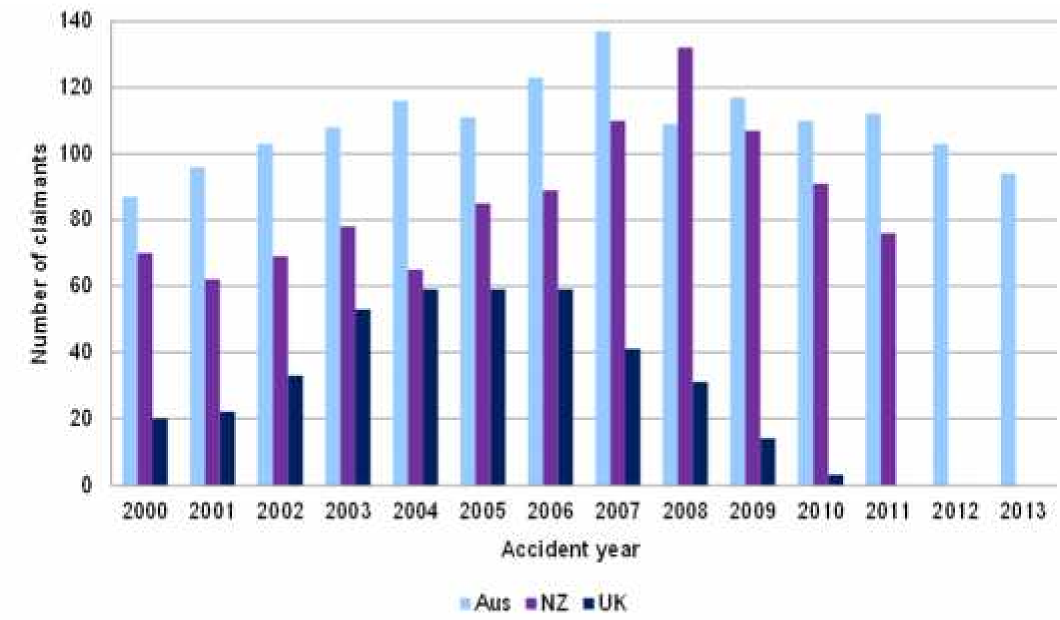
- The proportion of older claimants in the Victorian data is higher than in New Zealand. This is shown more clearly by the graph below. This may be due to differences in population demographics, or could also be related to the lower mortality rates in Victoria at older ages which are discussed later in the mortality rates section.

Distribution of male claimants by age at accident – Victoria vs New Zealand



4.7 The following graph shows the number of claims split by accident year for each territory.

Number of claims split by accident year



4.8 With the UK having 10 times the population and a similar road traffic accident injury rate to New Zealand you may expect the number of PPO claims by accident year to look at lot greater in the UK. There are a number of factors that mean the comparative UK exposure will be lower:

- PPOs have only been settling in the UK since 2008.
- The mean delay from accident date to settlement as a PPO is 6 years in the UK. Hence many claims that have already occurred will not be shown in the UK data yet.
- The New Zealand and Australian data includes all road traffic accident bodily injury claims, whereas the UK data only includes those claims that have settled as PPOs (only around a third of motor bodily injury claims above £1 million settle as a PPO).
- In addition, at fault injured drivers will not be included in the UK data but will be in the New Zealand and Victoria data.

4.9 The as at dates for the territories differ as well, with the New Zealand data being 15 month's older than the Victorian data which explains the lack of New Zealand data in 2012 and 2013:

- Victoria - as at June 2013
- UK - as at December 2012
- New Zealand - as at March 2012

4.10 The UK claim numbers tail-off significantly for accident dates after 2006, this is due to the long settlement delays for PPOs. The delay from the accident date to appearing in the data is much shorter under the New Zealand and Victorian systems.

4.11 The graph starts at accident year 2000, there are very few claims on the UK data occurring before this date but a very significant number exist in Victorian and New Zealand data as the history of data recorded goes back decades for these two territories.

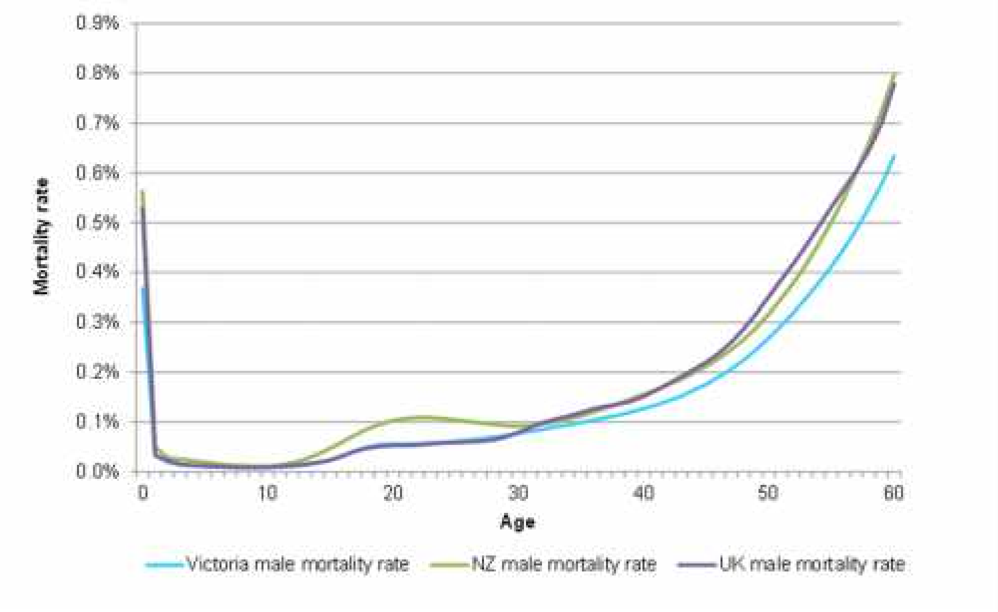
4.12 Brain injury categorisations were widened in New Zealand in 2007, which would account for the increase in claim numbers seen in the New Zealand data from 2006 to 2008.

4.13 The above also suggests that the numbers of PPOs that can be collated in the UK over future decades is unlikely to be significantly greater than in the other territories. The working party recommends companies collate data on all large bodily injury claims, not just PPOs going forward - it is possible that the propensity rate or criteria for settling bodily injury claims in the UK may change in the future.

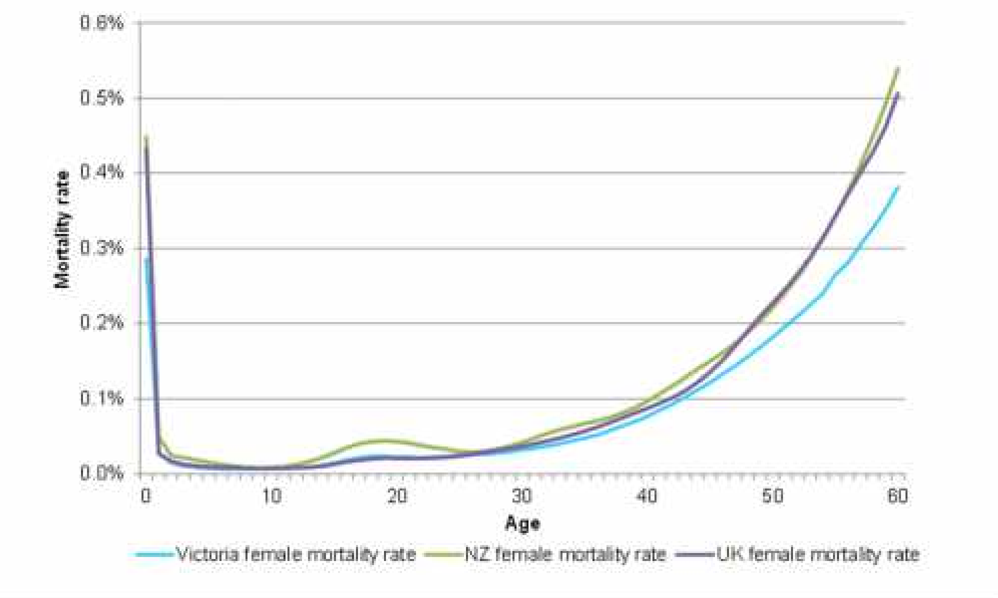
Mortality rates

4.14 How base population mortality rates differ by territory will impact the extent to which claimants life expectancies are reduced relative to the standard population. This chart compares the mortality rates in Victoria with those in New Zealand and the UK.

Male standard mortality comparison



Female standard mortality comparison



4.15 Mortality rates can be seen to be very similar across all three territories. We observe that the accident hump is more pronounced in New Zealand than either the UK or Victoria, and that mortality rates are lower in Victoria at older ages. This latter point may be at least part of the reason for why we are seeing a larger proportion of older claimants in the Victoria data relative to the New Zealand data.

4.16 The larger accident hump in New Zealand for those between the ages of around 15-30 could impact our analysis of multiplier adjustments by leading to lower multipliers at these ages for New Zealand.

Standard mortality data – sources

Territory	Population data
Victoria	2009-2011
New Zealand	2005-2007
UK	Ogden 7 (based on 2008 Office for National Statistics projections)

5. Methodology

5.1 The methodology is the same as that used in our analysis on New Zealand data last year. A brief summary is provided below - please refer to the Working Party's 2013 paper for full details.

5.2 The data was categorised according to gender and the five injury types outlined above. Claimants were then grouped into ten year age bands, as the data volumes were insufficient to assess the impact of injury on mortality rates at each individual age. The age groupings were based on the age at the time of exposure. So, for example, an individual who was aged eight at the time of injury and who was alive for five years during the period of investigation would contribute two years of exposure to the "0 – 9" age grouping and three years of exposure to the "10 – 19" age grouping, with the ages referring to age in complete years.

5.3 As a result of the lower volume of data available in respect of female claimants, the majority of the analysis focussed on male claimants. However, analysis was also performed on the data for female claimants using a broader grouping for injury type, to give a high level comparison to the male claimant analysis.

5.4 The expected number of deaths was calculated based on the State of Victoria population mortality tables applied to the exposure in each cohort.

Impairment adjustment methods

5.5 For each age band, observed multiplicative and additive mortality adjustments were calculated. We refer you to the Working Party's 2010 paper where different types of mortality adjustments were discussed in detail.

Multiplicative adjustment

5.6 This is equivalent to the ratio of the observed number of deaths to the expected number of deaths.

5.7 This approach can be a suitable if the expectation is that the additional mortality is expected to increase generally over a longer period. This kind of adjustment is used for impairments due to illnesses such as heart disease or diabetes.

Additive adjustment

5.8 This is akin to actual minus expected, that is the absolute difference between the number of deaths observed and the expected number of deaths, which is then divided by the exposure.

5.9 A constant addition can be applied, for example for myocardial infarction or less aggressive cancers such as breast cancer.

5.10 Alternatively a reducing addition variable might be more appropriate when extra mortality as a proportion of the total mortality decreases over time eg more aggressive cancers, where substantial extra mortality is experienced in the early years but where the differential reduces over time.

6. Limitations

6.1 The investigation is based on very limited data. Care should be taken not to place undue reliance on the results shown. Both the level of detail in the data and the volume of data available have limited the extent to which heterogeneity could be removed in selecting the data groupings. The limited volume of data also means that the results of the investigation are very sensitive to the random occurrence or absence of individual deaths.

6.2 The results are, however, valuable for giving us an indication of potential trends and in assessing whether or not the results support previous studies (in particular the findings on New Zealand data that were set out in the 2013 PPO Working Party paper).

6.3 Whilst the UK, New Zealand and Australia are all well developed countries with high standards of medical care, there will be differences in the environment that limit the extent to which the observed mortality experience in New Zealand and Victoria is relevant to expected mortality rates for UK PPO claimants. Examples include:

The compensation systems

6.4 In the UK only some of the serious injury claims are settled as PPOs, whereas in New Zealand and Victoria the data will include all road traffic accident bodily injury claims. The characteristics of claims that settle as PPOs may be different to those that are settled as lump sums in the UK.

Injury classification systems

6.5 The injury severity for each injury classification may differ between the datasets. This may partly explain why there are so few paraplegia injuries in the TAC data.

6.6 For UK PPO data claimants, we do not have the full injury classification. The injury severity for each classification used in our analysis may differ from the severity of an average PPO claimant in the UK.

Road type and conditions

6.7 This may affect the proportion of accidents that are severe. For example, New Zealand has a higher proportion of rural roads. This may explain why New Zealand has a higher death rate from road traffic accidents than Victoria or the UK and why a higher proportion of brain injuries arising from New Zealand accidents relate to severe injuries than in Victoria.

Driving standards

6.8 This will affect the frequency and severity of accidents. For example, one country may have more stringent requirements for learner drivers to obtain their full license resulting in safer drivers on the roads. This will lead to a lower rate of accidents in that country.

Type of vehicles driven

6.9 There may be a higher proportion of large vehicles on the roads in New Zealand and Victoria which may lead to a higher proportion of accidents resulting in severe injuries.

Medical care provisions

6.9 There may be differences in the quality of care between the three territories or in views on best practice (particularly for the most severe and complex conditions which may lead to differences in observed mortality). This may impact how long claimants live for after the accident.

6.10 However as all three countries are well developed, we would not expect there to be significant differences in the standard of medical care or medical practices.

Speed at which ambulance reaches the scene and distance to hospital

6.11 This will impact the severity of injuries and the likelihood of fatalities. In Victoria and New Zealand the distance to the nearest hospital is likely to be greater than in the UK since these territories are more sparsely populated. This may be why the death rate from road traffic accidents is higher in Victoria and New Zealand than the UK. It could also mean that more serious injury cases may survive in the UK with implications for subsequent relative mortality.

Impact of different death rates in the standard population

6.12 The mortality rate differs in each country as shown by the chart in section 4. This may impact the extent to which claimants life expectancies are reduced relative to the standard population.

Social attitudes towards drink driving and smoking

6.13 This will impact the frequency and severity of accidents as well as observed mortality rates. For example, it may be that drink driving is more common in New Zealand which is why the teenage accident hump is more pronounced than in Victoria or the UK.

Legislation

6.14 The legislation regarding the minimum driving license age, charges and penalties for traffic offences and speed limits will vary between jurisdictions and will impact the frequency and severity of car accidents.

Other

6.15 Specific data issues which affect the results are outlined in section 3. This is not intended to be an exhaustive list and there may be other issues that place constraints on the reliability of the results in the investigation.

6.16 We should recognise that one of the largest areas of uncertainty is how advances in medical science will affect future longevity. A cure for spinal injuries may be found one day for example. Such step change improvements in longevity mean that the observations of the past, as set out in an investigation such as this, may not reflect future patterns.

7. Results

7.1 The following areas of investigation are discussed here and compared to the experience in New Zealand:

- Injury type
- Severity of injury
- Gender
- Impact of time since accident
- Type of mortality adjustment

7.2 The type of mortality adjustment to use is also discussed in this section as well as the observations that if using a multiplier adjustment, this appears to decrease by age and the effect is more pronounced the more severe the injury.

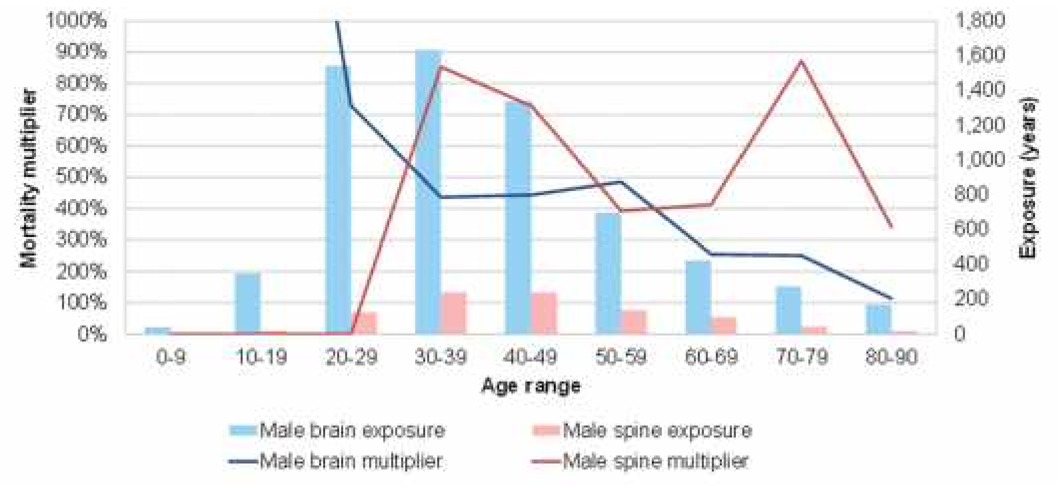
7.1. Injury type

7.1.1 Based on the following analysis, we conclude that spinal injuries have a greater impact on mortality than brain injuries.

7.1.2 The following two charts compare the observed multiplicative mortality rate adjustments for brain and spinal injury claimants in Victoria and in New Zealand respectively. The mortality multipliers are shown by the solid lines and the number of year's exposure by age range are shown by the bars.

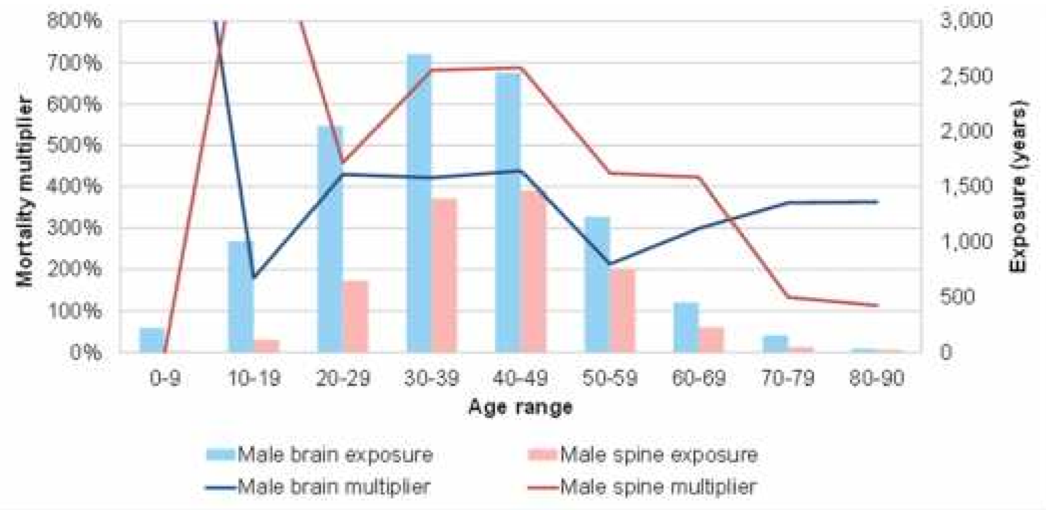
Victorian male injury mortality multipliers – brain vs spinal

Summary of Victorian male injury mortality multipliers



New Zealand male injury mortality multipliers – brain vs spinal

Summary of New Zealand male injury mortality multipliers



7.1.3 For both Victoria and New Zealand, the multiplicative adjustments for claimants with spinal injuries can arguably be seen to have consistently higher multipliers than those for brain injuries (hence we conclude that spinal injuries have a greater impact on mortality than brain injuries). However, it should be noted that there a relatively few spinal injuries in the Victoria data when compared to the New Zealand data meaning there is less credibility in the Victoria results relating to spinal cases.

7.1.4 In addition, it can be seen that credibility is low as a result of low exposure at the older and younger ages, so the reliability of the indications at these points should not be relied upon too heavily.

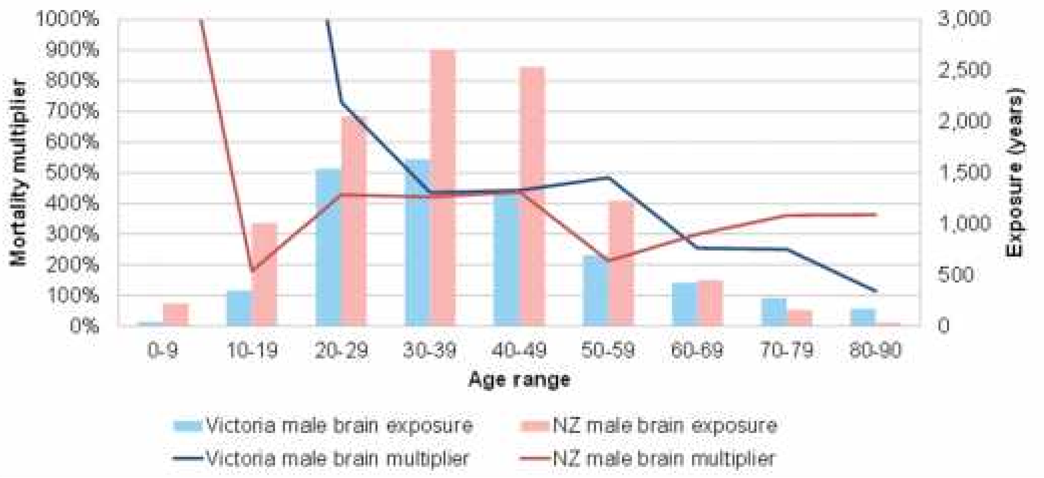
7.1.5 The table below shows the weighted average mortality multipliers for Victoria and New Zealand over all age groups. The figures support the hypothesis that spinal injuries have a greater impact on mortality than brain injuries. While measures such as these can give a simpler interpretation of the relative mortality between groupings (in this case brain and spinal), care must be taken when interpreting the results. This is discussed in more detail below.

Male mortality multiplier	Victoria	New Zealand
Overall	3.0	3.8
Brain	2.7	3.5
Spinal	5.4	4.3

7.1.6 The following chart compares the observed multiplicative mortality rate adjustments for brain injury claimants in Victoria and New Zealand.

Male brain injury mortality multipliers – Victoria vs New Zealand

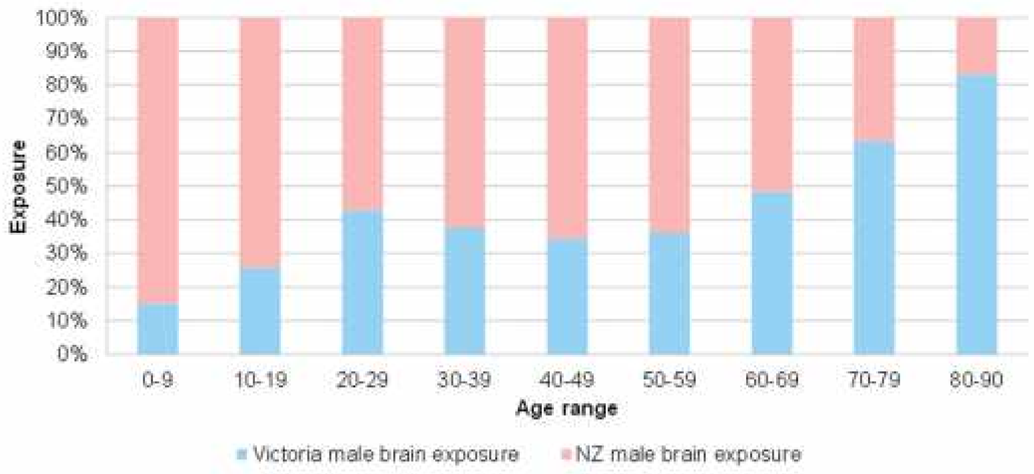
Summary of male brain mortality multipliers by country



7.1.7 The mortality multiplier for Victoria can be seen to be slightly higher at all age groups up to age 60 to that of New Zealand.

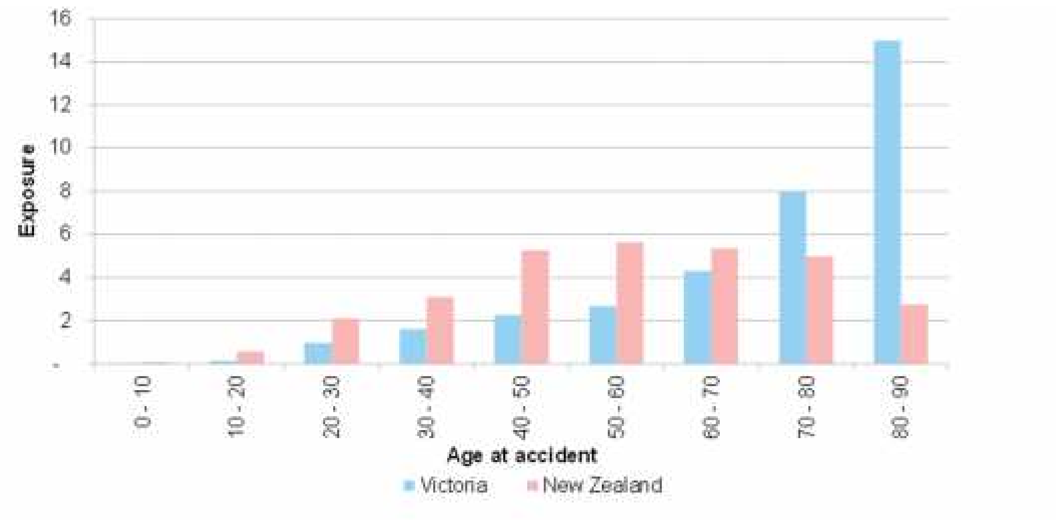
7.1.8 However the overall mortality multiplier for brain injuries for Victoria is lower at 2.7 than for New Zealand at 3.5 suggesting the opposite is true. This highlights the care needed in interpreting these results and the danger of taking a single point estimate. This apparent anomaly can be explained by the fact that the mix of exposures can be seen to be different between the two territories, with a significantly higher proportion of older lives in the Victoria data. This is highlighted in the following graph which shows the exposure bars stacked.

Relative distribution of exposure by age – New Zealand compared to Victorian brain injuries - stacked chart



7.1.9 Another element to consider is that there is arguably more credibility at older ages as the underlying mortality will be higher. The following graph highlights this by showing the expected number of deaths for the base population by age.

Number of expected deaths (based on base population mortality rates) – New Zealand compared to Victorian brain injuries



7.1.10 In addition, a downwards trend by age can be observed in the mortality multipliers.

7.1.11 This trend is much less obvious in the New Zealand data. However, as we know the mortality accident hump is greater between the ages of around 15-30 in New Zealand (see section 4), it would make sense that we would expect to see lower mortality multipliers at these ages. (The mortality multiplier is the ratio of observed to expected deaths; if the denominator, the expected deaths, is higher, then we would expect to see a lower multiplier for the same number of observed deaths).

7.1.12 Furthermore, the credibility of the data for New Zealand is relatively low at older ages, which is another reason why the downwards trend is less apparent at these ages.

7.2. Severity of injury

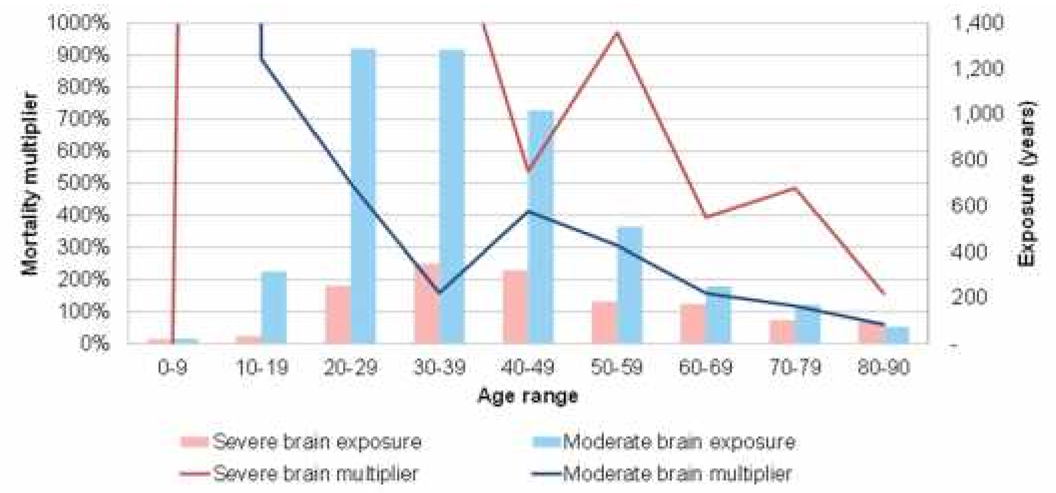
Brain

7.2.1 We conclude that the more severe the brain injury, the greater the mortality multiplier and hence the greater the impact on mortality.

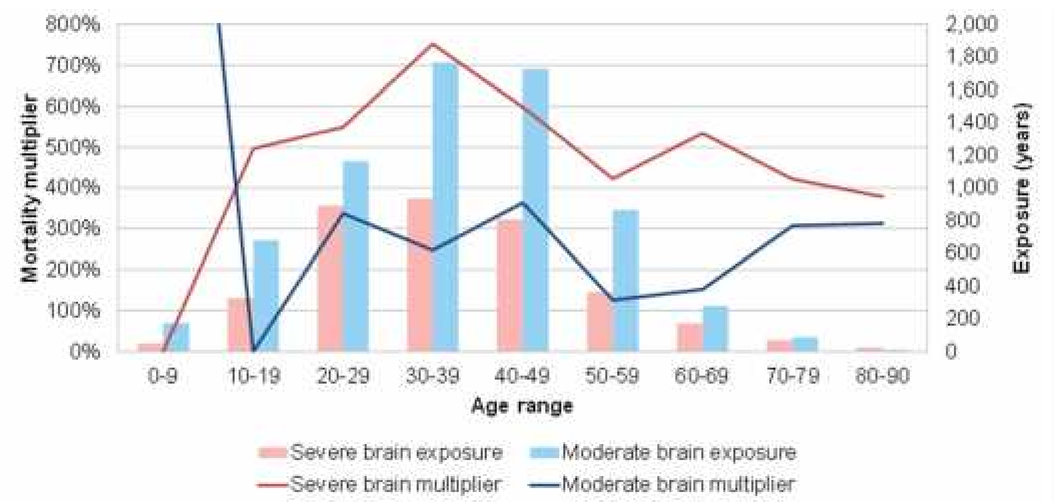
7.2.2 The following charts compare the observed multiplicative mortality rate adjustments for male brain injury claimants, in Victoria and New Zealand respectively, by injury severity.

Victorian male brain injury mortality multipliers by severity – moderate vs severe

Summary of male brain mortality multipliers by severity



New Zealand male brain injury mortality multipliers by severity – moderate vs severe



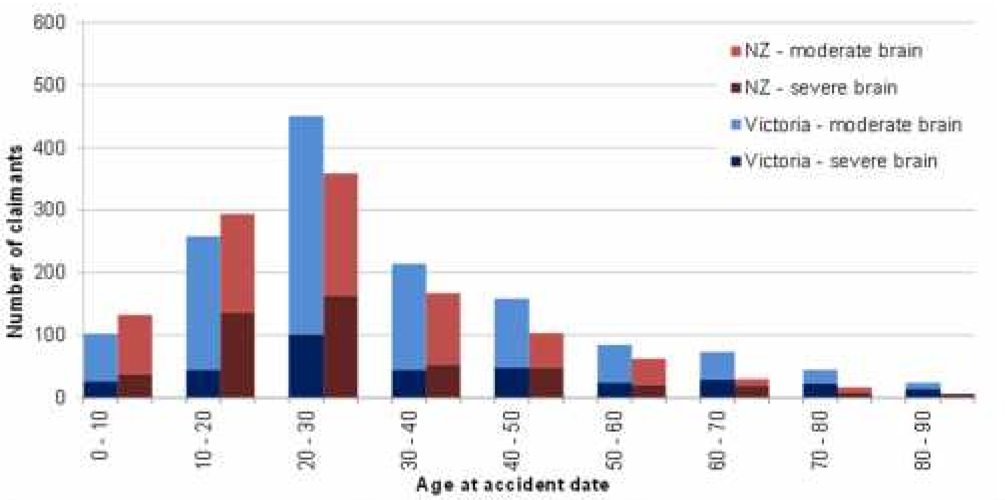
7.2.3 For both Victoria and New Zealand, the multiplicative adjustments for claimants with severe brain injuries are significantly higher than those for moderate injuries. This indicates that brain injury severity has a significant impact on mortality.

7.2.4 The following table shows the weighted average mortality multipliers for Victoria and New Zealand over all age groups

Male mortality multiplier New Zealand Victoria	New Zealand	Victoria
Overall Brain	3.5	2.6
Brain - Severe	5.0	3.7
Brain - Moderate	2.4	1.7

7.2.5 When interpreting the figures in the above table it should be noted that Victoria has a higher proportion of moderate brain injury claimants than New Zealand, and that Victoria has a higher proportion of older claimants. The following graph shows the split of brain injury types between claimants in Victoria and New Zealand by age at accident.

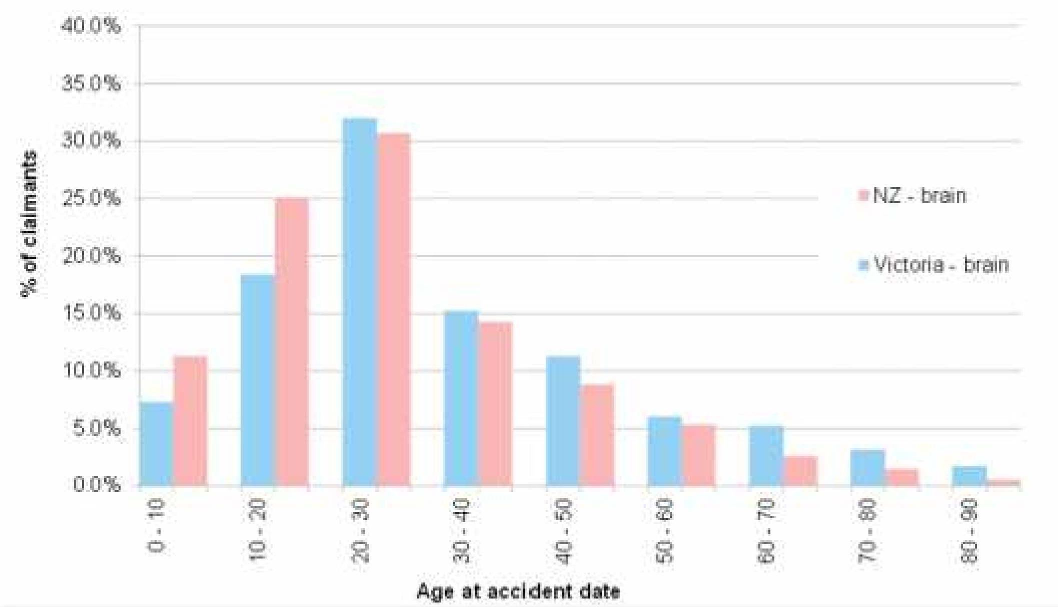
Number of male brain injury claimants split by severity and age at accident – Victoria vs New Zealand



7.2.6 This graph shows that Victoria has a higher proportion of moderate brain injury claimants than New Zealand.

7.2.7 The following graph compares the distribution of male brain injury claimants for Victoria and New Zealand by age at accident.

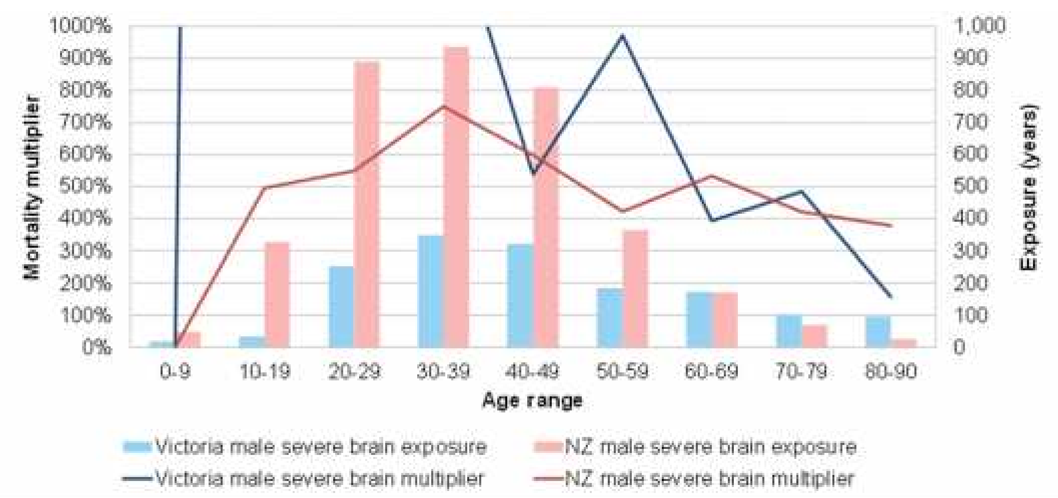
Distribution of male brain injury claimants by age at accident – Victoria vs New Zealand



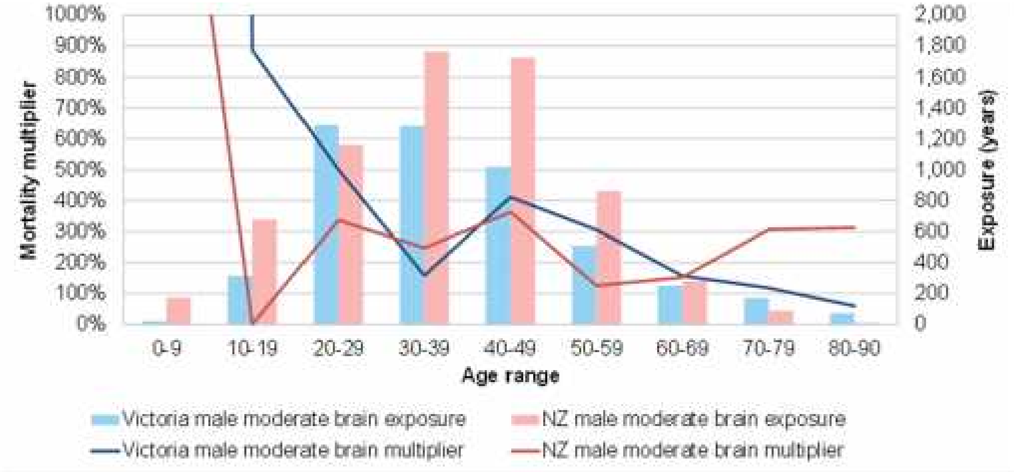
7.2.7 This graphs show that Victoria has a higher proportion of older claimants which is why the overall weighted average mortality multiplier for brain injuries appears to be lower for Victoria than New Zealand. Also, there are a higher proportion of moderate brain injury claimants in Victoria.

7.2.8 The following two graphs shows mortality multiplier results for severe brain and moderate brain injuries respectively by territory.

Male brain injury severe mortality multipliers – Victoria vs New Zealand



Male brain injury moderate mortality multipliers – Victoria vs New Zealand



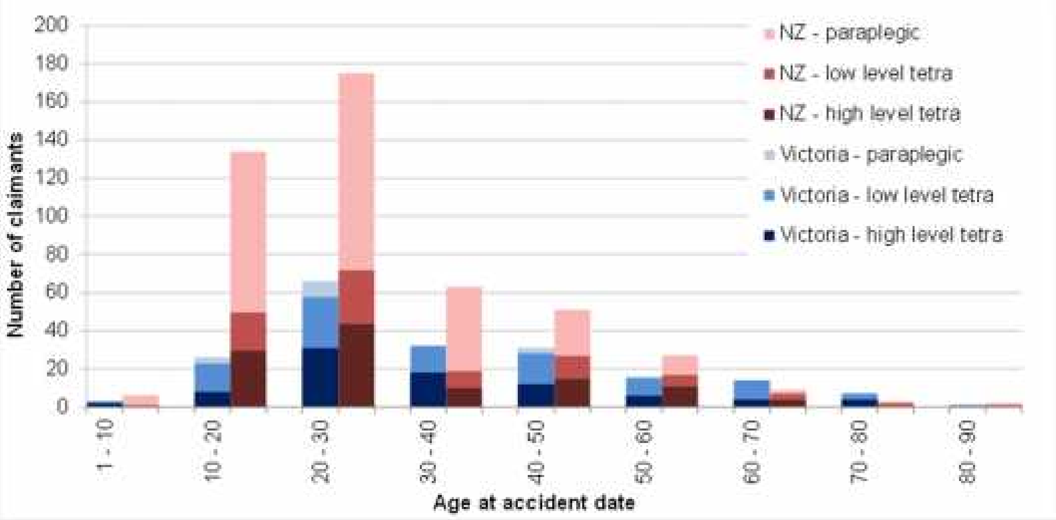
7.2.9 These charts again suggest a downward trend in the observed mortality multipliers that brain injuries have a greater impact on younger claimant's life expectancies. This is logical in that you would expect individuals to be more likely to die from other causes at older ages. It should be noted that at older ages, especially for New Zealand the exposure and hence data credibility is relatively minimal and that the larger accident hump for New Zealand at the ages of around 15-30 is likely to be reducing the mortality multipliers at these ages.

Spinal

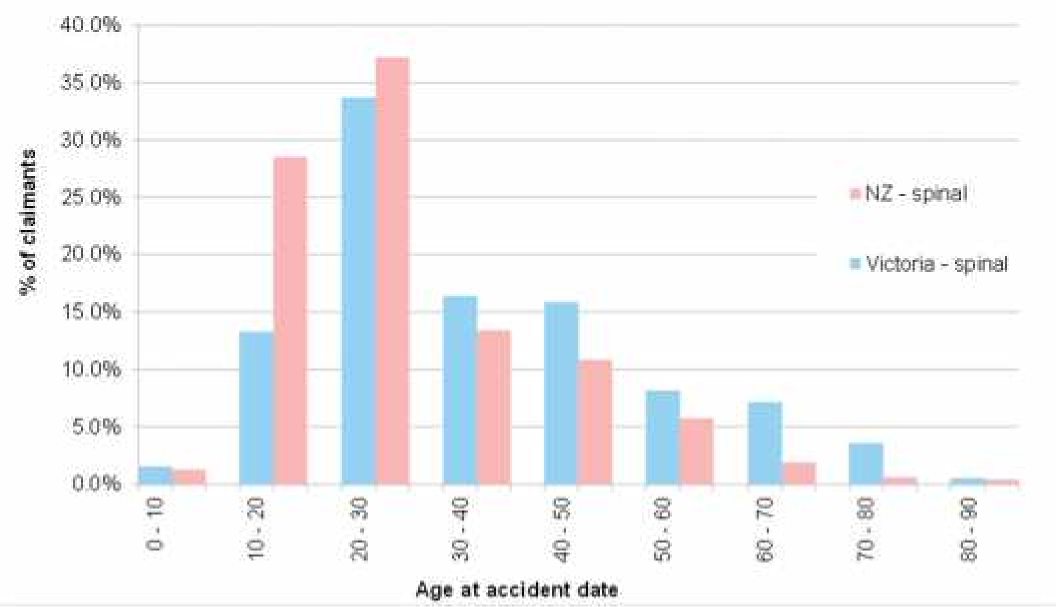
7.2.10 Similar to that seen with brain injury, the more severe the spinal injury severity the higher the mortality multiplier.

7.2.11 Both the Victoria and the New Zealand data categorize spinal injuries into high tetraplegia, low tetraplegia and paraplegia. However, as shown in the following graph, in the Victoria data, there is not enough exposure to give credible results for paraplegia so we have not included these in our analysis. TAC were unable to explain the relative differences in the split of spinal injuries between New Zealand and Victoria.

Number of male spinal injury claimants by severity and age at accident – Victoria vs New Zealand

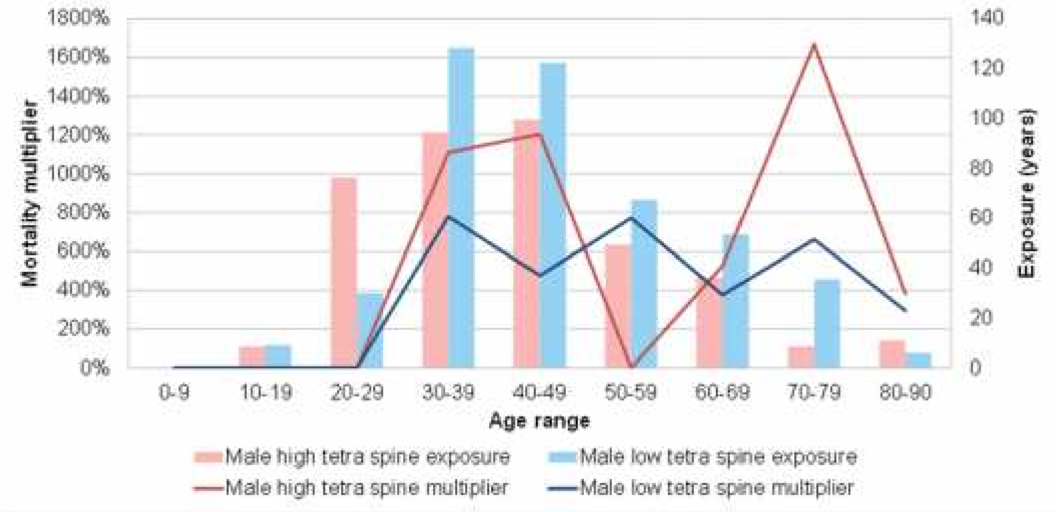


Distribution of male spinal injury claimants by age at accident – Victoria vs New Zealand



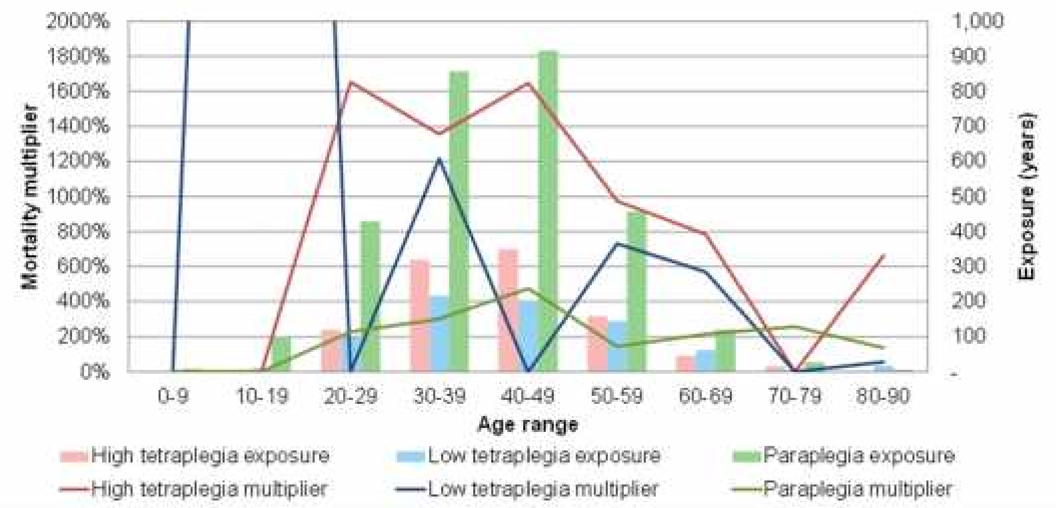
7.2.12 The following chart shows the observed multiplicative mortality rate adjustments for male spinal injury claimants in Victoria by injury severity.

Victoria male spinal injury mortality multipliers by severity



7.2.13 The following chart compares the observed multiplicative mortality rate adjustments for male spinal injury claimants in New Zealand by injury severity.

New Zealand male spinal injury mortality multipliers by severity



7.2.14 It should be noted that the Victorian data contains a relatively minimal amount of data for spinal injuries so will be less credible than the results observed from the New Zealand data. The multiplicative adjustments for claimants with high tetraplegia spinal injuries are higher than those with less severe injuries.

7.2.15 There is again evidence of a downward trend with increasing age in the observed mortality multipliers. However, again, when interpreting the results it should be noted that at the younger and older ages there is less credibility and that the larger accident hump for New Zealand at ages around 15-30 may be causing lower multipliers at these ages.

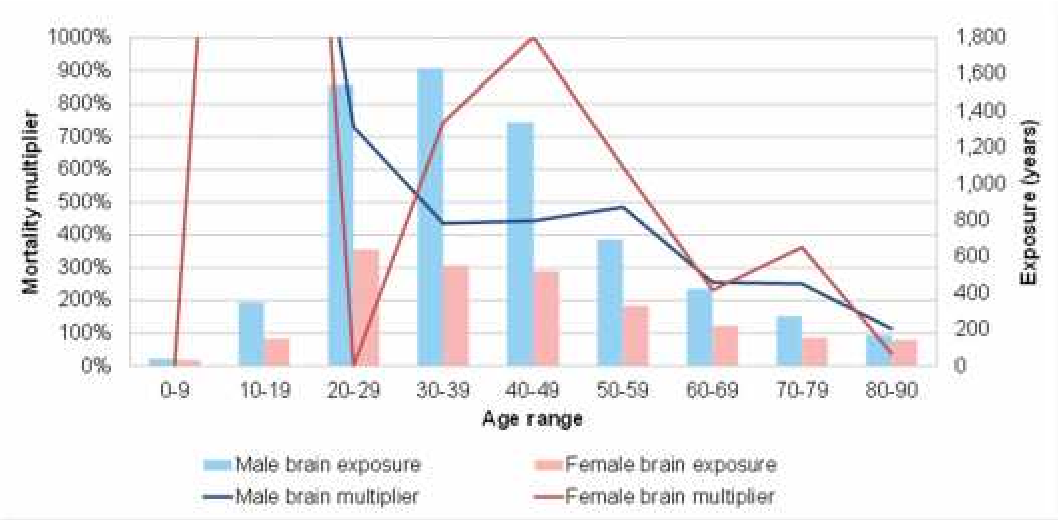
7.2.16 The following table shows the weighted average mortality multipliers for Victoria and New Zealand over all age groups. As discussed previously care needs to be taken when interpreting these results to take into account the differences in the mix of claim exposure by age and by injury severity between territories.

Male mortality multiplier	Victoria	New Zealand
Overall Spinal	5.4	4.3
Overall tetraplegia	5.6	6.2
High tetraplegia	6.4	10.0
Low tetraplegia	5.1	3.4
Paraplegia	-	2.6

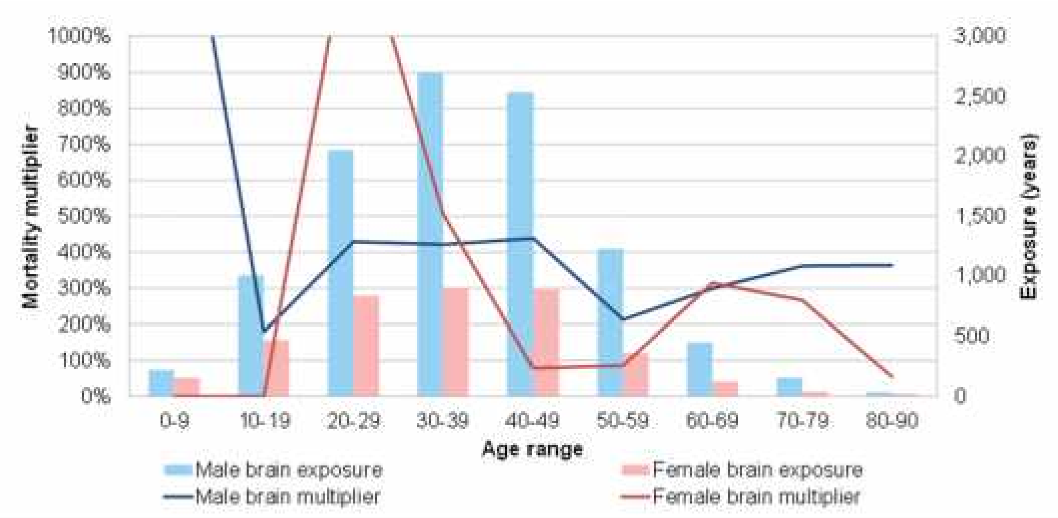
7.3. Gender

7.3.1 The following two charts compare the observed multiplicative mortality rate adjustments for male and female brain injury claimants in Victoria and New Zealand respectively.

Victorian brain injury mortality multipliers by gender



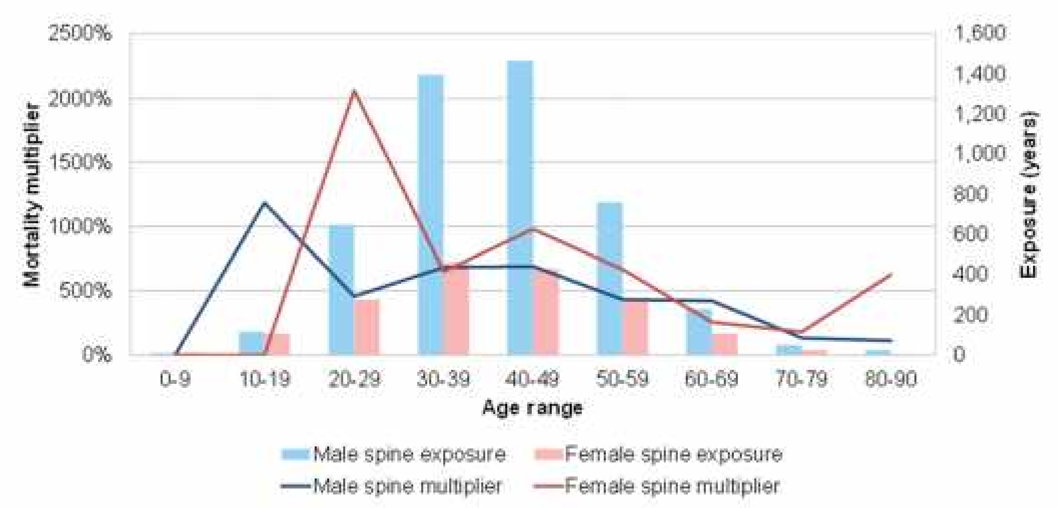
New Zealand brain injury mortality multipliers by gender



7.3.2 The results for each territory show conflicting results. Whereas the multiplicative adjustments for Victoria indicate that brain injuries have a greater impact on female mortality than male, the same measure for New Zealand show the opposite. There is no clear rationale why this would be the case.

7.3.3 The following chart compares the observed multiplicative mortality rate adjustments for male and female spinal injury claims in New Zealand. In the Victoria data, there is not enough exposure to female spinal injuries to give credible results.

New Zealand spine injury mortality multipliers by gender



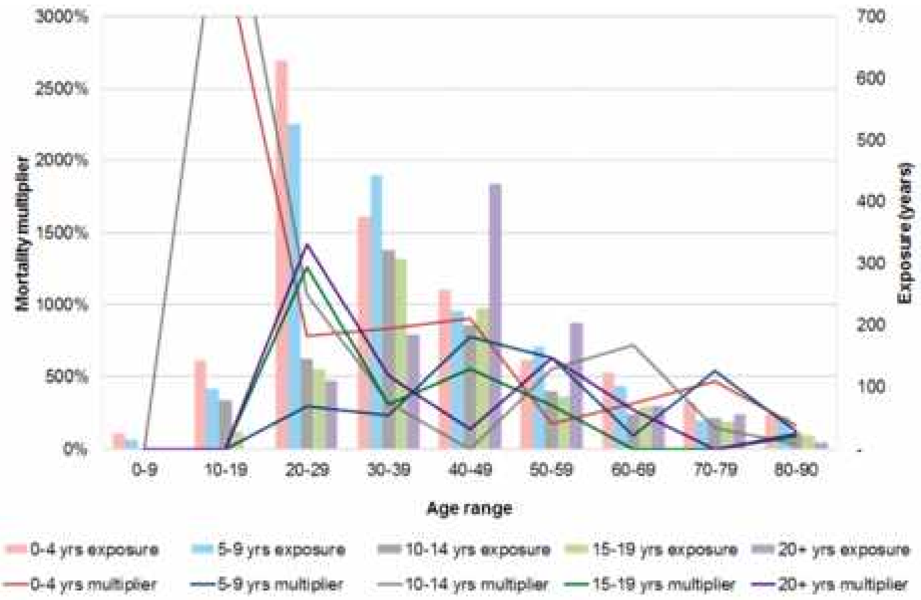
7.3.4 Last year we concluded that for the New Zealand experience the observed multipliers were broadly similar for males and females for both brain and spinal injury, except for in the age group 20 to 29 where the observed female multipliers are higher. We surmised that part of the reason for this is that males experience a larger base mortality in the 20 to 29 age range than females owing to the 'accident hump'. Hence the multiplier, which is calculated relative to base mortality, is observed to be lower for males than for females for this age band.

7.4. Impact of time since injury

7.4.1 We looked at whether period elapsed since the accident has an impact on mortality rates. Whilst the results did not show anything to support the view that time since accident has any impact, we recognise that when splitting the data down into so much detail, we lose credibility. Hence our view is that the volume of data is too limited for us to come to any conclusions on this question.

7.4.2 This chart shows how the time since accident impacts the observed mortality multipliers.

Victorian comparison of male brain injury multipliers by time since accident



7.5. Methods of mortality adjustment

7.5.1 The above results look at results from applying mortality multiplier adjustment to age.

7.5.2 However there are other types of adjustment that can be used.

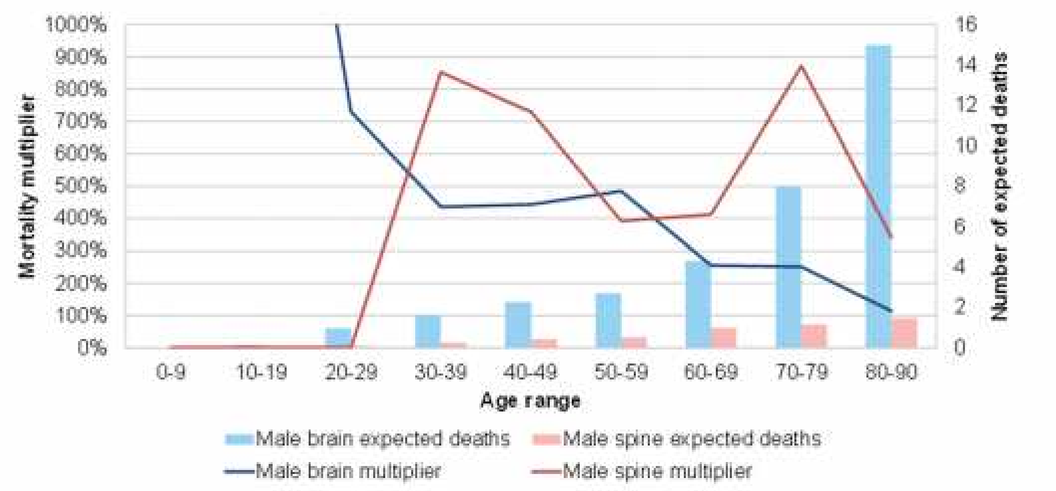
Multiplier adjustment

7.5.3 This is equivalent to the ratio of the observed number of deaths to the expected number of deaths.

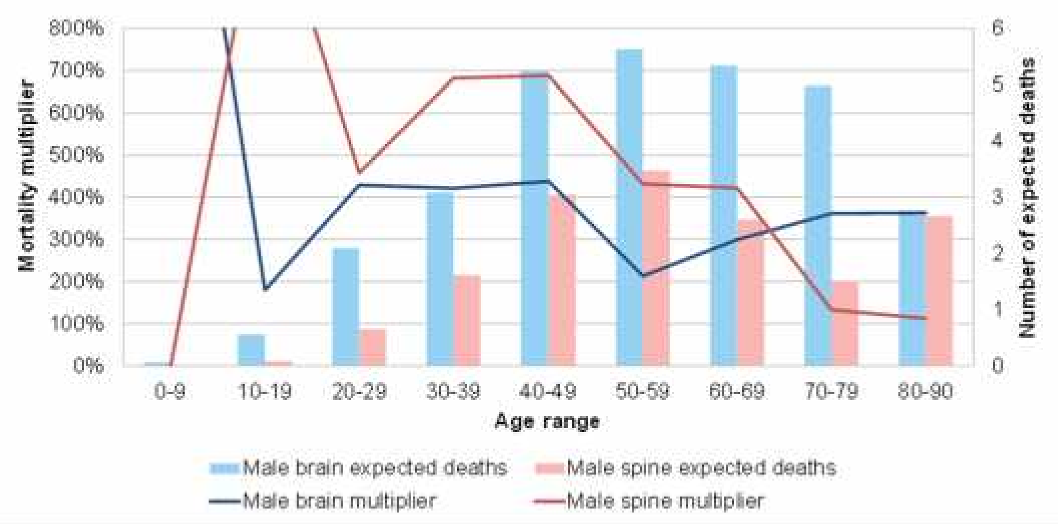
7.5.4 As has been discussed in the above sections, a downwards trend by age can be observed in the mortality multipliers and this trend seems more pronounced the more serious the injury. This trend seems logical if you consider that the multiplier represents the ratio of observed to expected deaths; at older ages the expected deaths will be higher and claimants at older ages will be more likely to die of causes other than those relating to their injury.

7.5.5 The following graphs show these observed downward trends on various injuries and territories: (Note: the following graphs are repeated -they have also been shown in previous sections).

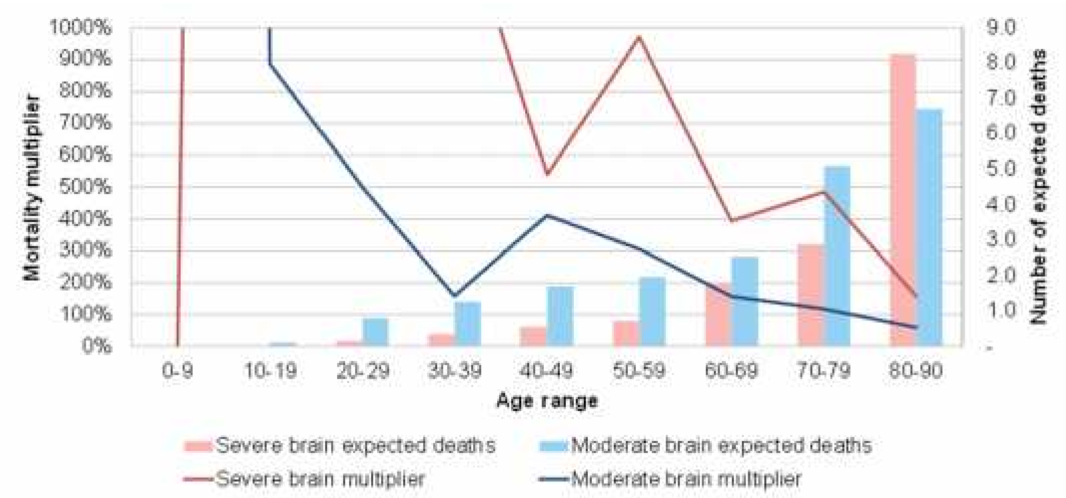
Victorian male injury mortality multipliers – brain vs spinal



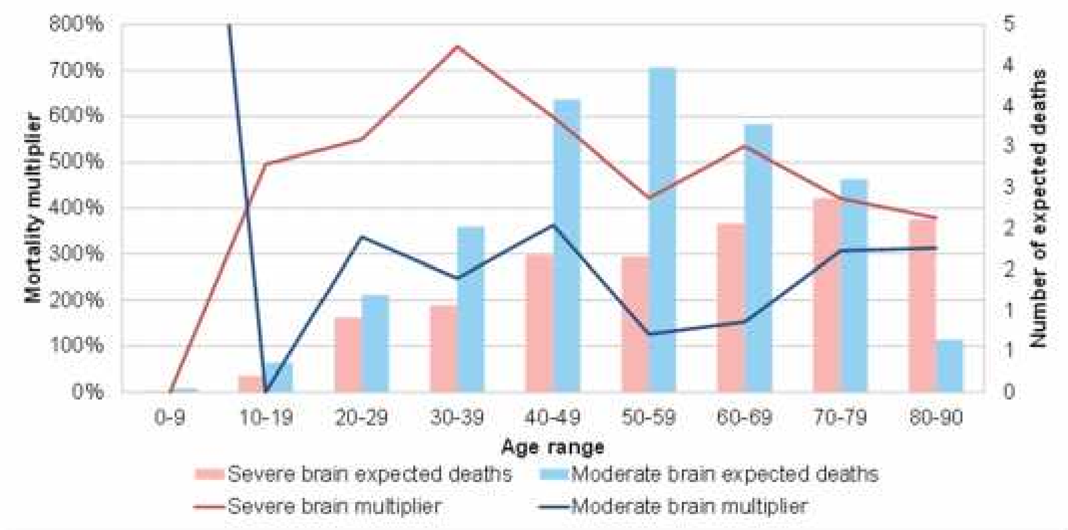
New Zealand male injury mortality multipliers – brain vs spinal



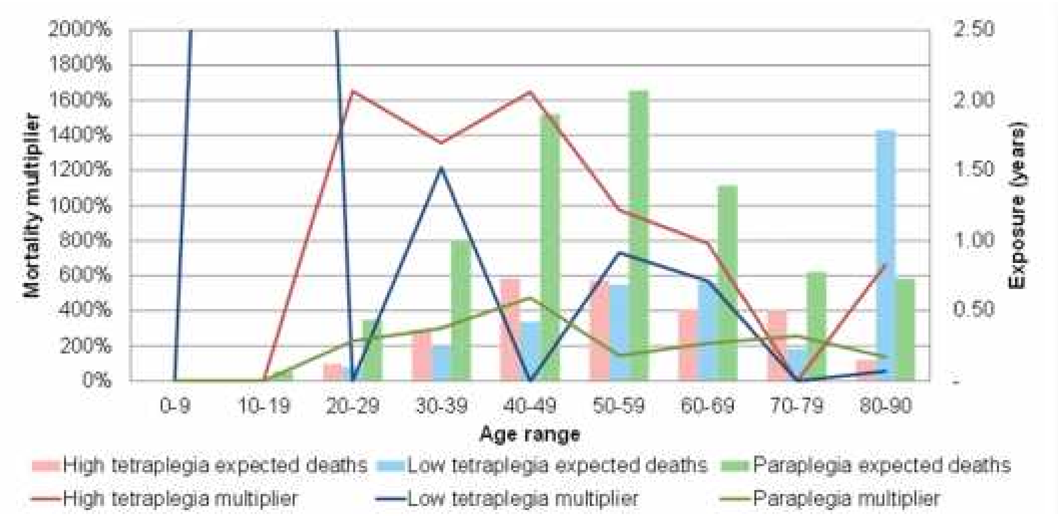
Victorian male brain injury mortality multipliers – moderate vs severe



New Zealand male brain injury mortality multipliers – moderate vs severe



New Zealand male spinal injury mortality multipliers by severity



7.5.6 There is not enough data on Victorian spinal injury claims to be able to carry out a credible analysis.

7.5.7 The downward trend is much less obvious in the New Zealand data than the Victorian data. As explained previously this is likely to be due to the fact that:

- The mortality accident hump is greater between the ages of around 15-30 in New Zealand (see section 4), As a result we might expect to see lower mortality multipliers at these ages (the mortality multiplier is the ratio of observed to expected deaths, if the denominator, the expected deaths, is higher, then we would expect to see a lower ratio for the same number of observed deaths).
- And also that the credibility of the data for New Zealand is relatively low at older ages, so it is not surprising if the trend is less apparent in the New Zealand data at these ages.

7.5.8 There have been investigations in to spinal injury mortality in the US carried out by Strauss. The graph below compares the observed multipliers from the New Zealand data with the Strauss findings from the US data. Whilst the New Zealand multipliers are higher overall, the trends observed are similar.

Comparison of New Zealand and Strauss multipliers for spinal injury

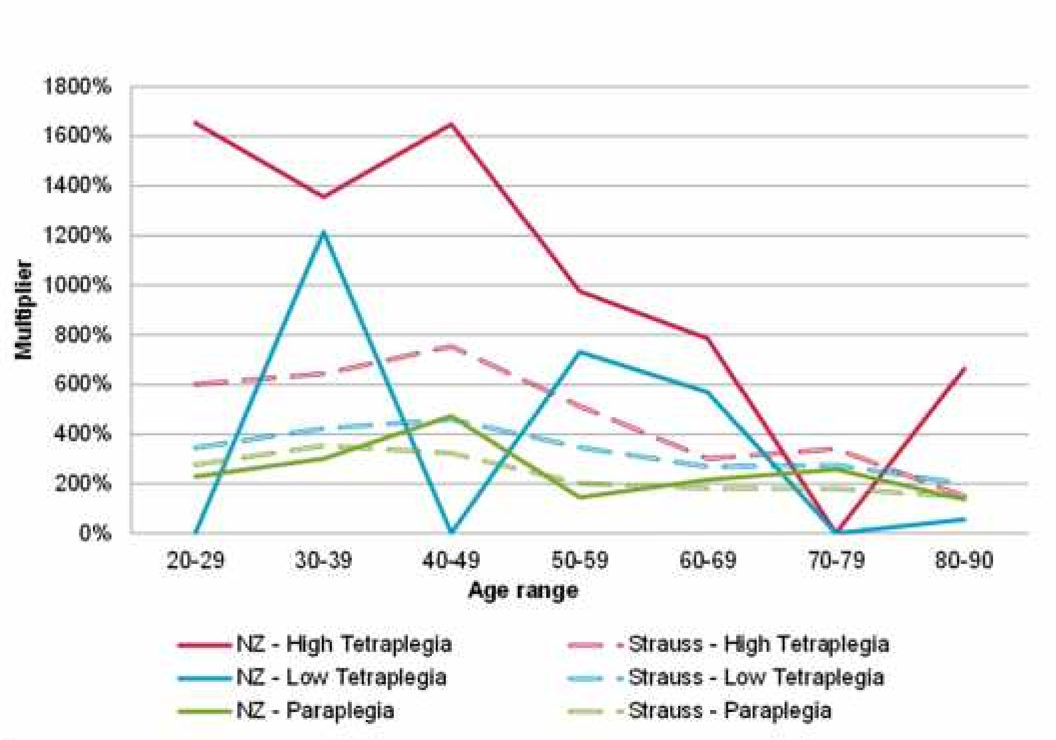


Table of results

7.5.9 The observed multipliers for each injury are shown in the table below. As discussed elsewhere, care needs to be taken when interpreting these figures and the impact of exposure taken into account.

Victorian male mortality multipliers

Age	High tetraplegia	Low tetraplegia	Paraplegia	Severe brain	Moderate brain
0-9	0.0	0.0		0.0	475.7
10-19	0.0	0.0		176.0	8.9
20-29	0.0	0.0		18.9	5.0
30-39	11.1	7.8		14.5	1.6
40-49	12.0	4.8		5.4	4.1
50-59	0.0	7.7		9.7	3.1
60-69	5.3	3.8		3.9	1.6
70-79	16.7	6.6		4.8	1.2
80-90	3.8	2.9		1.6	0.6
Total (0-90)	6.4	5.1	N/A	3.7	1.7
Total exposure	384	452	80	1,534	4,931

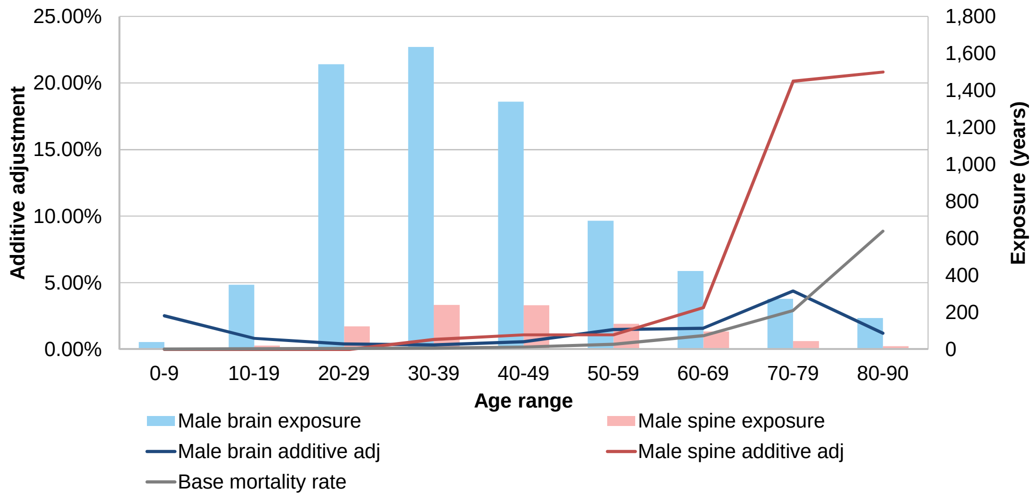
Age	High tetraplegia	Low tetraplegia	Paraplegia	Severe brain	Moderate brain
0-19	0.0	0.0		147.1	17.4
20-39	7.2	6.8		15.9	2.9
40-59	5.8	6.4		7.8	3.5
60-90	6.4	4.7		2.6	1.0
Total (0-90)	6.4	5.1	N/A	3.7	1.7
Total exposure	384	452	80	1,534	4,931

Additive adjustment

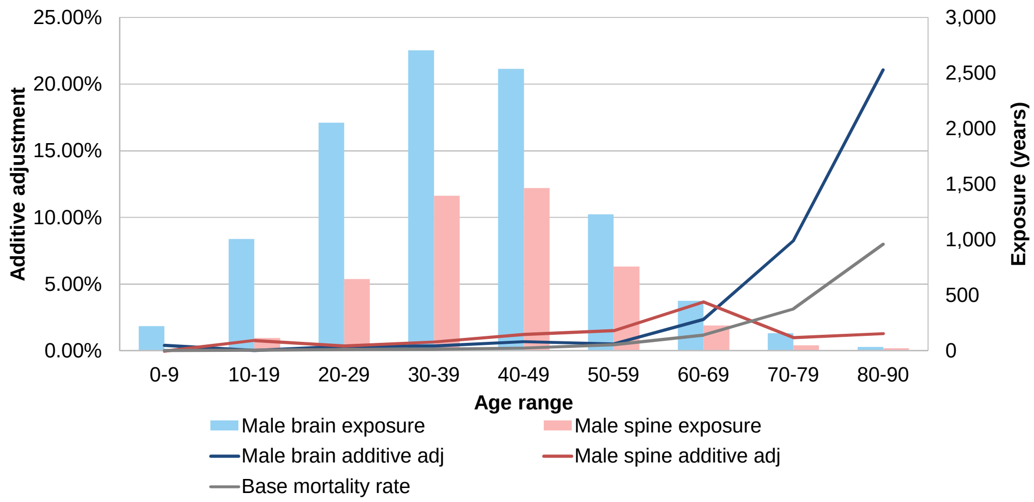
7.5.9 This is the absolute difference between the observed number of deaths and the expected number of deaths divided by the exposure. The shape of the adjustment by age seems to be flat at lower ages, increasing at older ages.

7.5.10 The following two charts compare the observed additive mortality rate adjustments for brain and spinal injury claimants in Victoria and in New Zealand respectively. The additive adjustments are shown by the solid lines and the number of year's exposure by age range are shown by the bars. The base mortality for the standard population is also shown in grey to give indication of the relative size of the adjustment.

Victorian male injury additive mortality adjustments – brain vs spinal



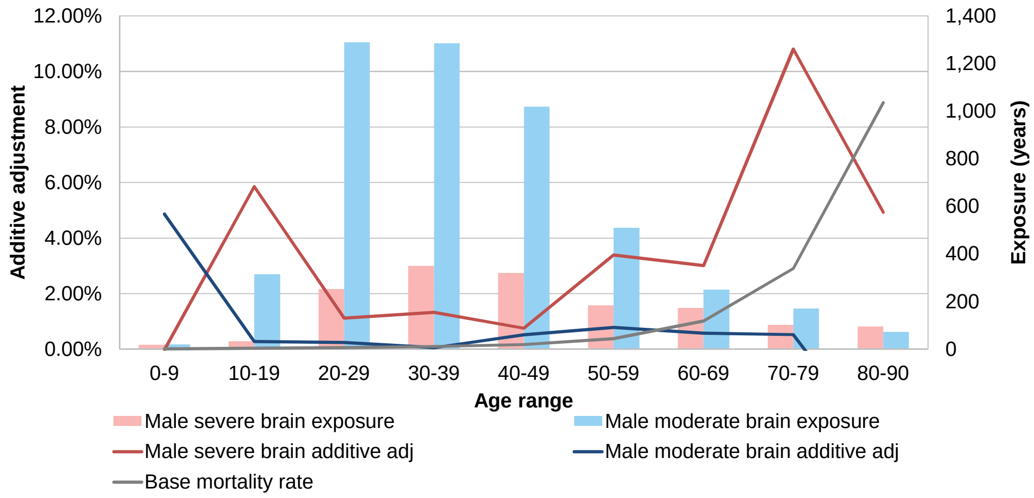
New Zealand male injury additive mortality adjustments – brain vs spinal



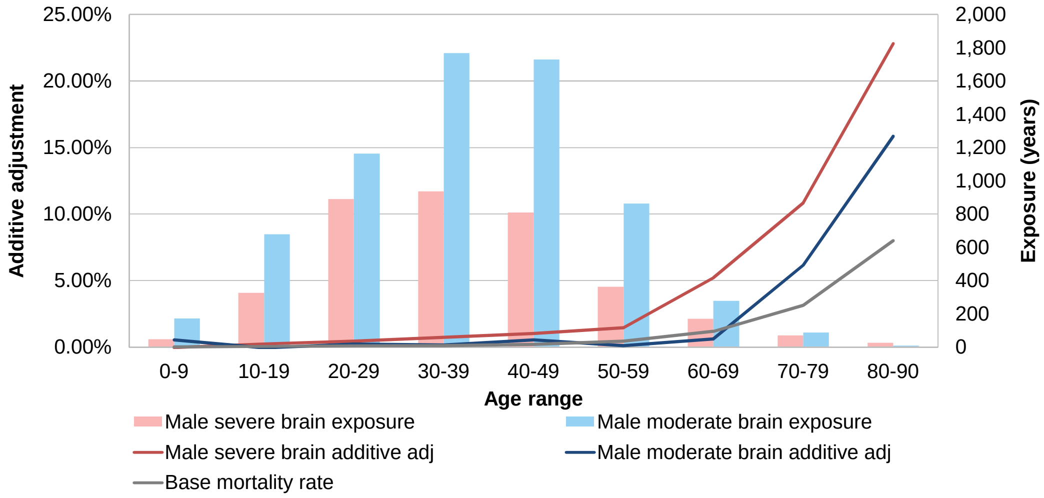
7.5.11 For both Victoria and New Zealand, the additive adjustments for claimants with spinal injuries can arguably be seen to have consistently higher adjustments than those for brain injuries up until the older age ranges (hence we conclude that spinal injuries have a greater impact on mortality than brain injuries). At the older age ranges there is limited data and therefore the results are less credible.

7.5.12 The following two charts compare the observed additive mortality rate adjustments for brain injury claimants in Victoria and in New Zealand respectively, by injury severity.

Victorian male brain injury additive mortality adjustments by severity

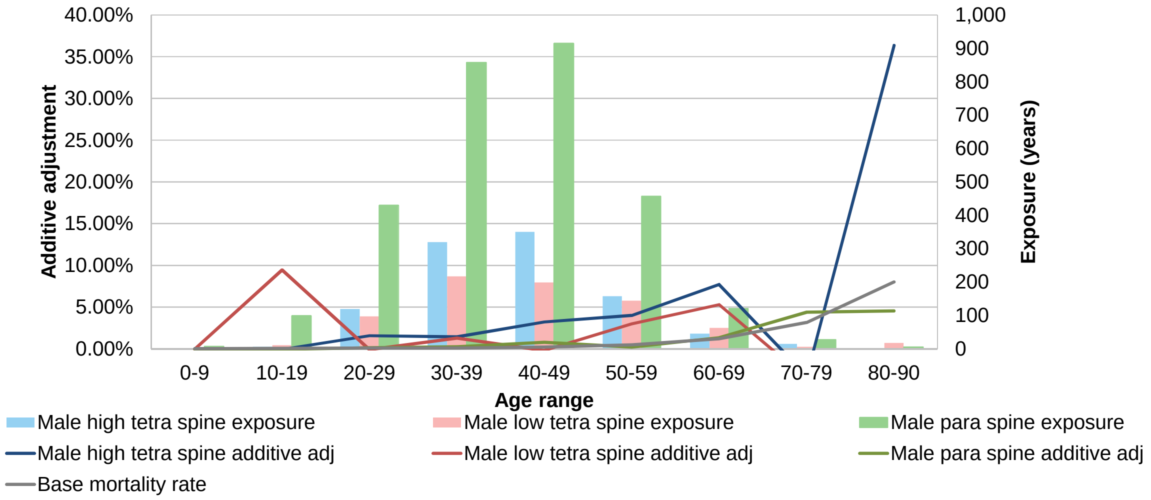


New Zealand male brain injury additive mortality adjustments by severity



7.5.13 The following chart compares the observed additive mortality rate adjustments for brain injury claimants in New Zealand, by injury severity.

New Zealand male spinal injury additive mortality adjustments by severity



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https://www.gov.uk/government/statistics/reported-road-casualties-in-great-britain-main-results-2013

Appendix A - Injury classifications

Type	TAC	ACC
Brain	ABI – low	6: Moderate brain injury
Brain	ABI – medium	5: Severe brain injury
Brain	ABI – high	5: Severe brain injury
Spine	Quadriplegia - low	2: Low level tetraplegia
Spine	Quadriplegia - high	1: High level tetraplegia
Spine	Noncat & paraplegia	8: Comparable diagnosis
Other	Noncat	3: Paraplegia
Other	Quadriplegia: functional code E	2: Incomplete spinal injury

Appendix B – Base mortality rates

	Victoria		New Zealand	
Age	Male	Female	Male	Female
0	0.00368	0.00286	0.00563	0.00448
1	0.00033	0.00028	0.00050	0.00049
2	0.00019	0.00015	0.00028	0.00025
3	0.00014	0.00011	0.00025	0.00022
4	0.00013	0.00009	0.00022	0.00019
5	0.00011	0.00008	0.00019	0.00016
6	0.00010	0.00007	0.00016	0.00013
7	0.00010	0.00007	0.00013	0.00011
8	0.00009	0.00007	0.00012	0.00009
9	0.00009	0.00007	0.00011	0.00008
10	0.00010	0.00007	0.00011	0.00009
11	0.00010	0.00008	0.00013	0.00010
12	0.00011	0.00009	0.00018	0.00013
13	0.00013	0.00010	0.00025	0.00017
14	0.00017	0.00012	0.00035	0.00022
15	0.00023	0.00015	0.00047	0.00028
16	0.00032	0.00019	0.00060	0.00035
17	0.00042	0.00022	0.00074	0.00040
18	0.00050	0.00024	0.00086	0.00043
19	0.00055	0.00024	0.00096	0.00044
20	0.00056	0.00023	0.00103	0.00043
21	0.00056	0.00023	0.00107	0.00041
22	0.00056	0.00022	0.00109	0.00038
23	0.00058	0.00023	0.00109	0.00035
24	0.00059	0.00024	0.00107	0.00033
25	0.00061	0.00025	0.00104	0.00030
26	0.00064	0.00026	0.00101	0.00029
27	0.00066	0.00027	0.00098	0.00030
28	0.00070	0.00028	0.00095	0.00033
29	0.00073	0.00030	0.00093	0.00037
30	0.00077	0.00032	0.00092	0.00042
31	0.00081	0.00034	0.00093	0.00048
32	0.00085	0.00037	0.00096	0.00054
33	0.00090	0.00040	0.00100	0.00059
34	0.00094	0.00044	0.00106	0.00063
35	0.00099	0.00048	0.00112	0.00067
36	0.00104	0.00052	0.00120	0.00071
37	0.00109	0.00058	0.00128	0.00075
38	0.00114	0.00064	0.00137	0.00081
39	0.00120	0.00070	0.00146	0.00088
40	0.00127	0.00077	0.00156	0.00097
41	0.00134	0.00085	0.00165	0.00107
42	0.00143	0.00093	0.00176	0.00117
43	0.00152	0.00102	0.00186	0.00128
44	0.00164	0.00112	0.00199	0.00139
45	0.00176	0.00122	0.00212	0.00150
46	0.00191	0.00133	0.00228	0.00161

	Victoria		New Zealand	
Age	Male	Female	Male	Female
47	0.00207	0.00144	0.00246	0.00174
48	0.00225	0.00156	0.00266	0.00188
49	0.00246	0.00169	0.00290	0.00204
50	0.00269	0.00182	0.00317	0.00221
51	0.00294	0.00196	0.00347	0.00241
52	0.00320	0.00210	0.00380	0.00262
53	0.00349	0.00225	0.00417	0.00287
54	0.00379	0.00240	0.00457	0.00313
55	0.00412	0.00265	0.00501	0.00342
56	0.00447	0.00281	0.00549	0.00375
57	0.00486	0.00305	0.00602	0.00410
58	0.00530	0.00327	0.00660	0.00449
59	0.00579	0.00351	0.00725	0.00492
60	0.00634	0.00381	0.00797	0.00539
61	0.00697	0.00419	0.00877	0.00590
62	0.00768	0.00455	0.00965	0.00647
63	0.00849	0.00494	0.01063	0.00708
64	0.00940	0.00543	0.01172	0.00776
65	0.01042	0.00604	0.01291	0.00851
66	0.01157	0.00663	0.01424	0.00935
67	0.01284	0.00739	0.01569	0.01031
68	0.01426	0.00811	0.01732	0.01138
69	0.01583	0.00912	0.01914	0.01260
70	0.01755	0.01025	0.02119	0.01396
71	0.01944	0.01168	0.02351	0.01547
72	0.02152	0.01269	0.02612	0.01713
73	0.02383	0.01410	0.02905	0.01895
74	0.02647	0.01570	0.03232	0.02094
75	0.02948	0.01756	0.03593	0.02317
76	0.03294	0.01977	0.03990	0.02571
77	0.03691	0.02242	0.04423	0.02865
78	0.04145	0.02559	0.04893	0.03206
79	0.04663	0.02936	0.05404	0.03602
80	0.05250	0.03380	0.05977	0.04062
81	0.05911	0.03900	0.06634	0.04594
82	0.06652	0.04502	0.07399	0.05208
83	0.07477	0.05195	0.08292	0.05911
84	0.08390	0.05983	0.09334	0.06712
85	0.09393	0.06873	0.10533	0.07625
86	0.10472	0.07870	0.11863	0.08663
87	0.11613	0.08980	0.13286	0.09839
88	0.12804	0.10204	0.14769	0.11163
89	0.14029	0.11547	0.16280	0.12642
90	0.15318	0.13010	0.17787	0.14260
91	0.17020	0.14624	0.19267	0.15999
92	0.18653	0.16090	0.20946	0.17841
93	0.20171	0.18042	0.22710	0.19767
94	0.21892	0.20138	0.24541	0.21762
95	0.23151	0.21983	0.26483	0.23866

96	0.24387	0.23742	0.28527	0.26074
	Victoria		New Zealand	
Age	Male	Female	Male	Female
97	0.25261	0.25367	0.30667	0.28376
98	0.26498	0.26822	0.32890	0.30762
99	0.27379	0.28246	0.35185	0.33220
100	0.28632	0.29469	0.37537	0.35735