



Institute
and Faculty
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GIRO Periodic Payment Orders Working Party

GIRO 2014 Workshop B4
Mortality and reinsurance update

24 September 2014



2014 Workstreams

Mortality – UK

- Nick Betteridge, Canopus and Tina Ruffle, Aviva

Mortality – Australian

- Sarah MacDonnell, LCP

Reinsurance

- Peter Saunders, Swiss Re

Market Solution

- Frank Chacko, NFU

Bodily injury almanac

- Fiona Annandale, KPMG

PPO Guidance Note-Information Paper

- Keith Brown, AXA

Industry Survey

- Emma Potter, Towers Watson

Bodily Injury Classification

- Sarah MacDonnell, LCP



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Background to PPOs

What is a PPO?

A PPO is a contingent, deferred, whole-life, wage inflation linked, guaranteed, impaired annuity , where the identity of the annuitant and the size of the annual payments are unknown at inception.

What is a PPO?

A PPO is complicated.



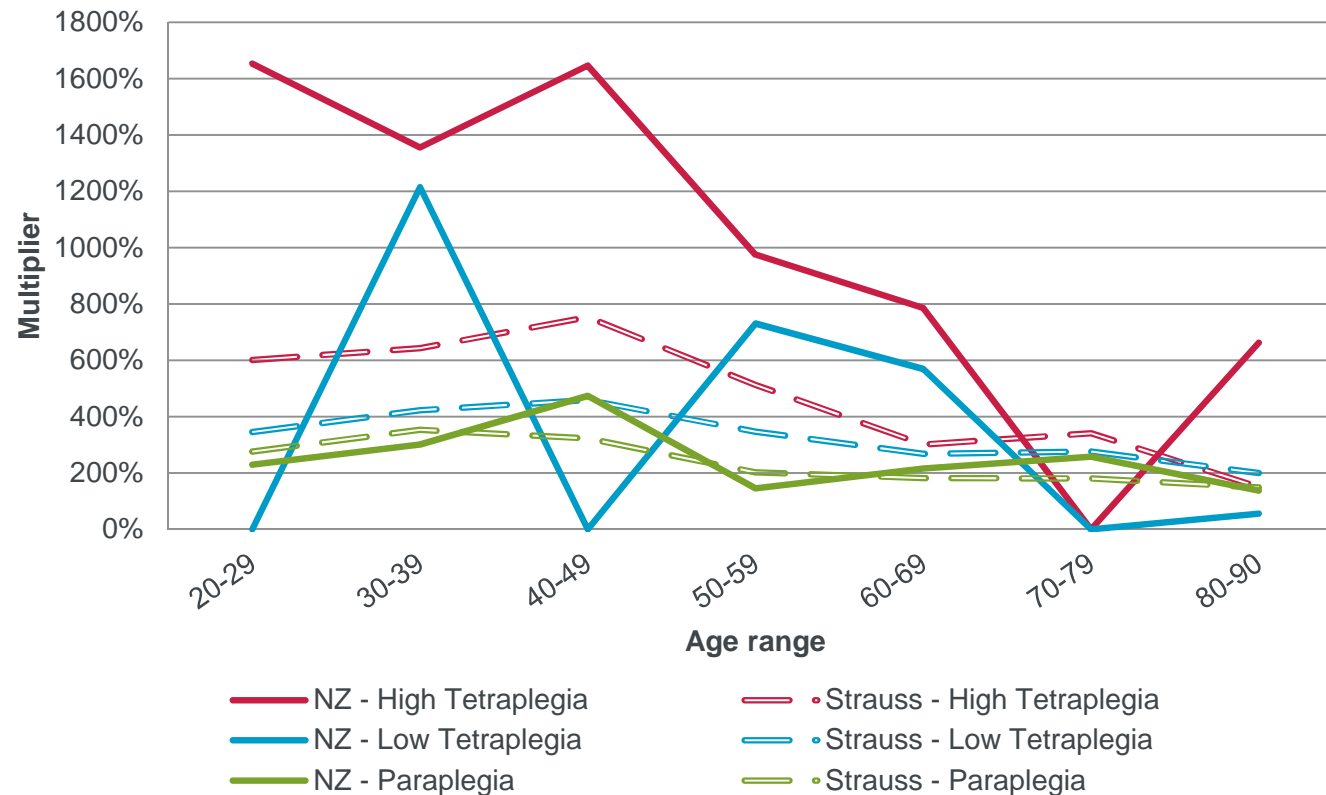
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Mortality Matters

Australian Road Traffic Accident mortality
experience

Mortality matters

- Limited UK PPO experience – only settling since 2008
- Look at brain and spinal mortality experience from around the world to inform trends



Mortality matters

Victoria, Australia and New Zealand have been operating state schemes for decades



With thanks to

- Antony Claughton – DLG
- Darryl Frank – PwC, Australia
- David Gifford - TAC (Transport Accident Commission)
- Katie Salisbury, Phil Moss, Hayley Rigby and Daniel Fess – LCP

Contents

- Country comparisons
- Findings
 - High level conclusions
 - Investigation details
 - Interpretation of results – take care!
- How to use this information

Background

| | 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 NZ - Motor only 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 |

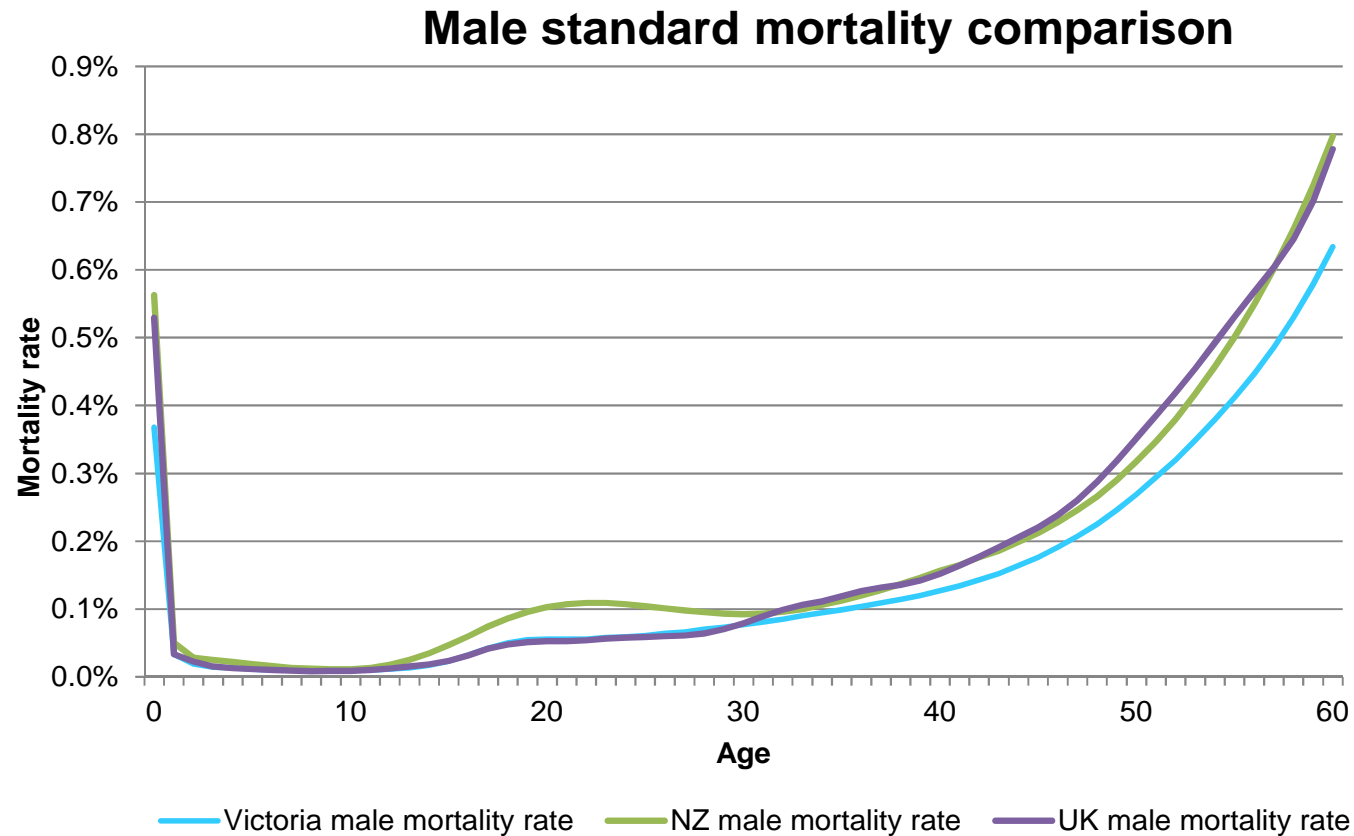
Comparable size of Victoria and New Zealand to the UK

| Comparison to UK | Victoria | New Zealand |
|--------------------|----------|-------------|
| Population | 9% | 7% |
| Number of vehicles | 13% | 9% |
| RTA death rate | 1.6 | 2.0 |
| RTA injury rate | N/A | 0.9 |

Caveats

- Injury classification system
- Road type and conditions
- Driving standards
- Type of vehicles driven
- Medical care provision
- Care systems
- Impact of different death rates

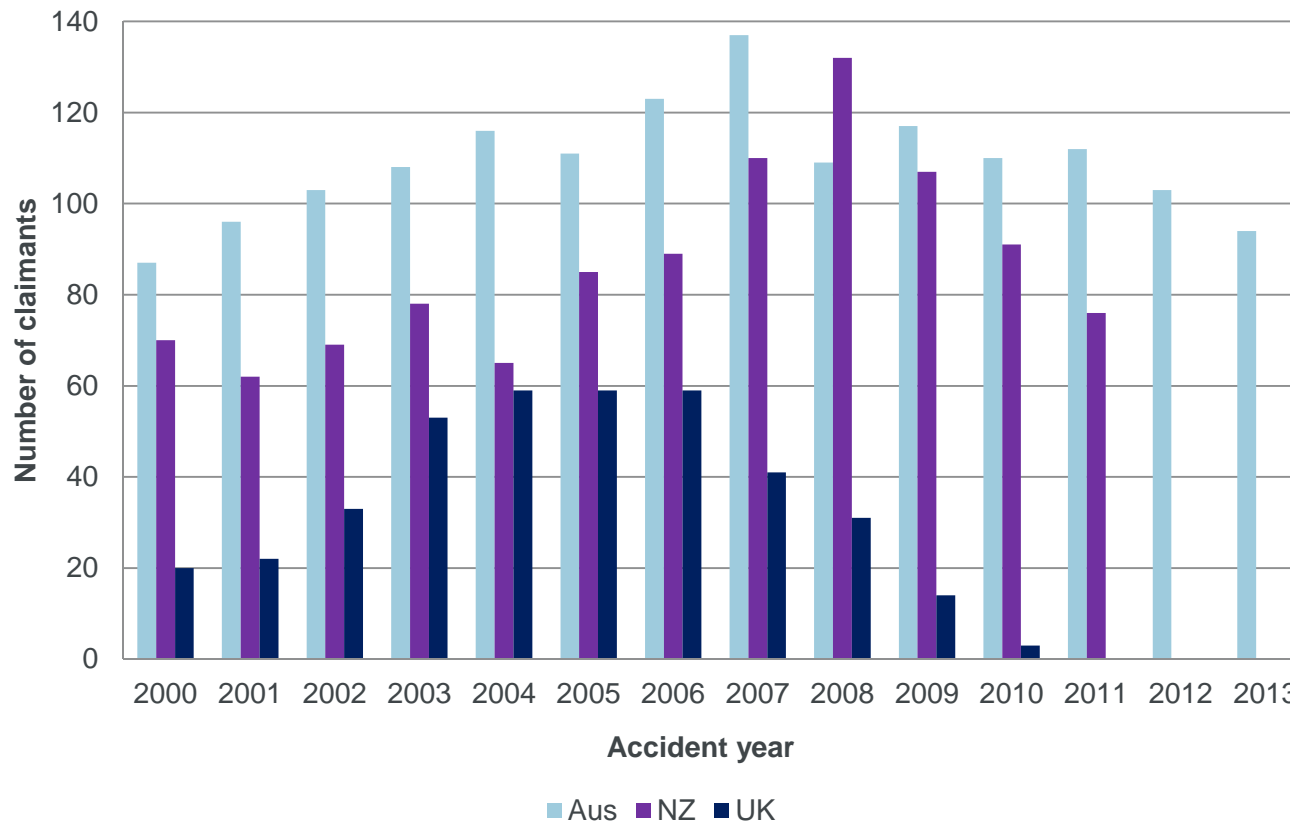
UK, NZ and Victoria standard mortality curves



- Victoria standard mortality curve based on population data for 2009-2011
- New Zealand standard mortality curve based on population data for 2005-2007
- UK standard mortality curve based on Ogden 7

Number of claims split by accident year

- accident years 2000 to 2011

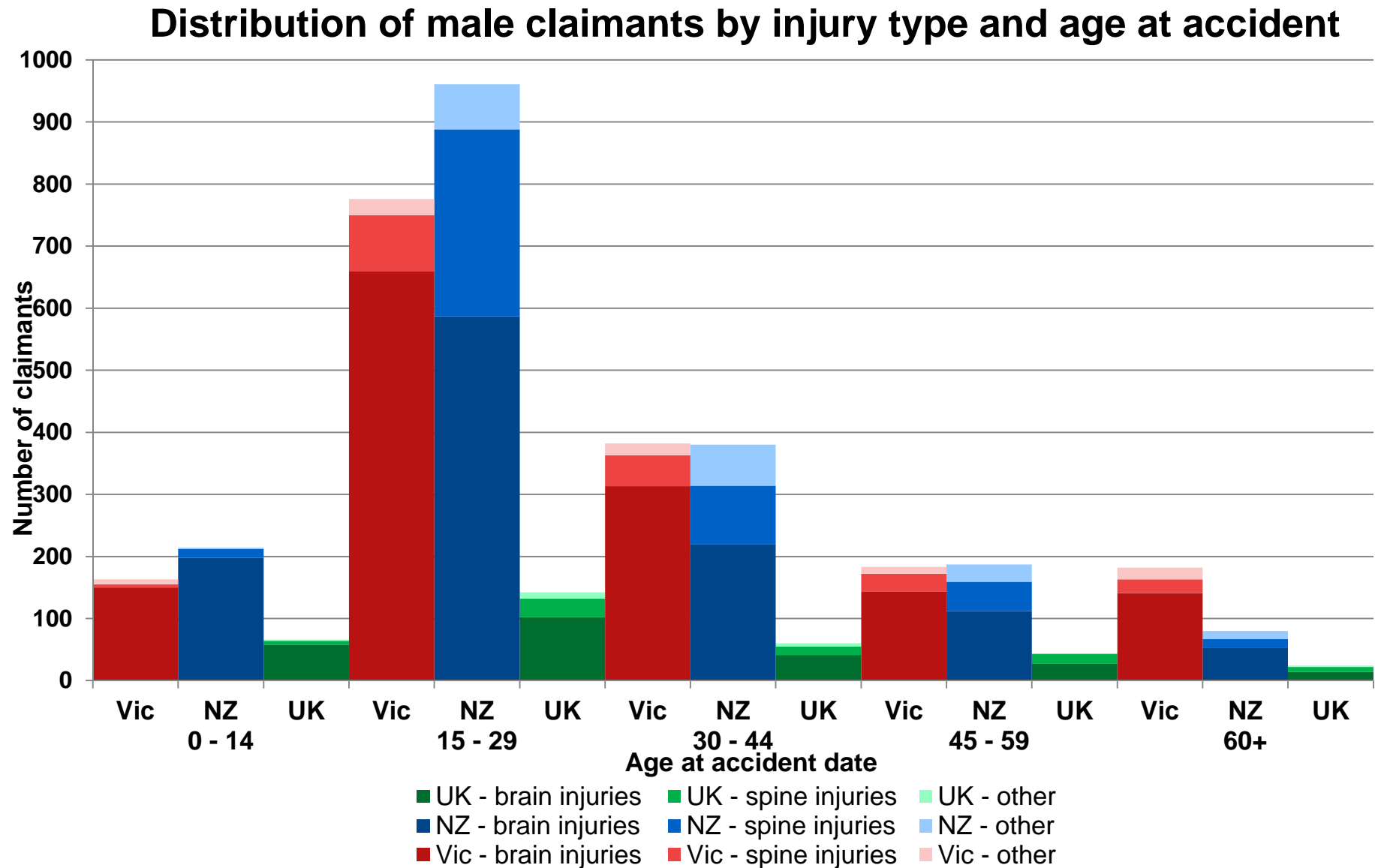


*Australian years run from July to June, NZ and UK from Jan to Dec

Differences

- Victorian data as at June 2013
 - UK - Dec 2012
 - NZ - Mar 2012
- NZ and Australia include all claims, including at fault drivers
- Only a third of large motor BI claims settle as PPOs
- UK PPOs only started settling in 2008
 - PPOs take on average 6 years to settle
 - Early stages of development
- NZ brain injury categorisation widened in 2007

Distribution by age and injury type



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High level findings are consistent with those from NZ last year

Spinal injuries have higher mortality rates than brain injuries

Severity of injury is significant

Working Party UK Injury Categorisation

Brain Injury

| Code | Description | |
|------|----------------------------------|---------------------------------------------------------------------------------|
| 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 |
| B5 | Walks well alone | Walks well alone for at least 20 feet, and balances well |
| B6 | No mobility issues | |

- Spinal and amputation codes (S1-S5 and A1-A4)

Working Party UK Injury Categorisation

Care regime

| Code | Description | |
|------|--------------------------------------|-------------------------------------------------------------------------------|
| 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 | Walks with support, or unsteadily alone at least 10 feet but does not balance |
| C5 | 5 to 8 hours duty care a day | Walks well alone for at least 20 feet, and balances well |
| C6 | 0 to 4 hours duty care a day | |
| C7 | Domestic help only, no personal care | |
| C8 | No regular care | |

Tips

- Record for all BI claims over £1 million
 - not just PPOs
- Record history of injury definition as it changes over time

High level findings are consistent with those from NZ last year

Spinal injuries have higher mortality rates than brain injuries

Severity of injury is significant

Multiplier reduces by age

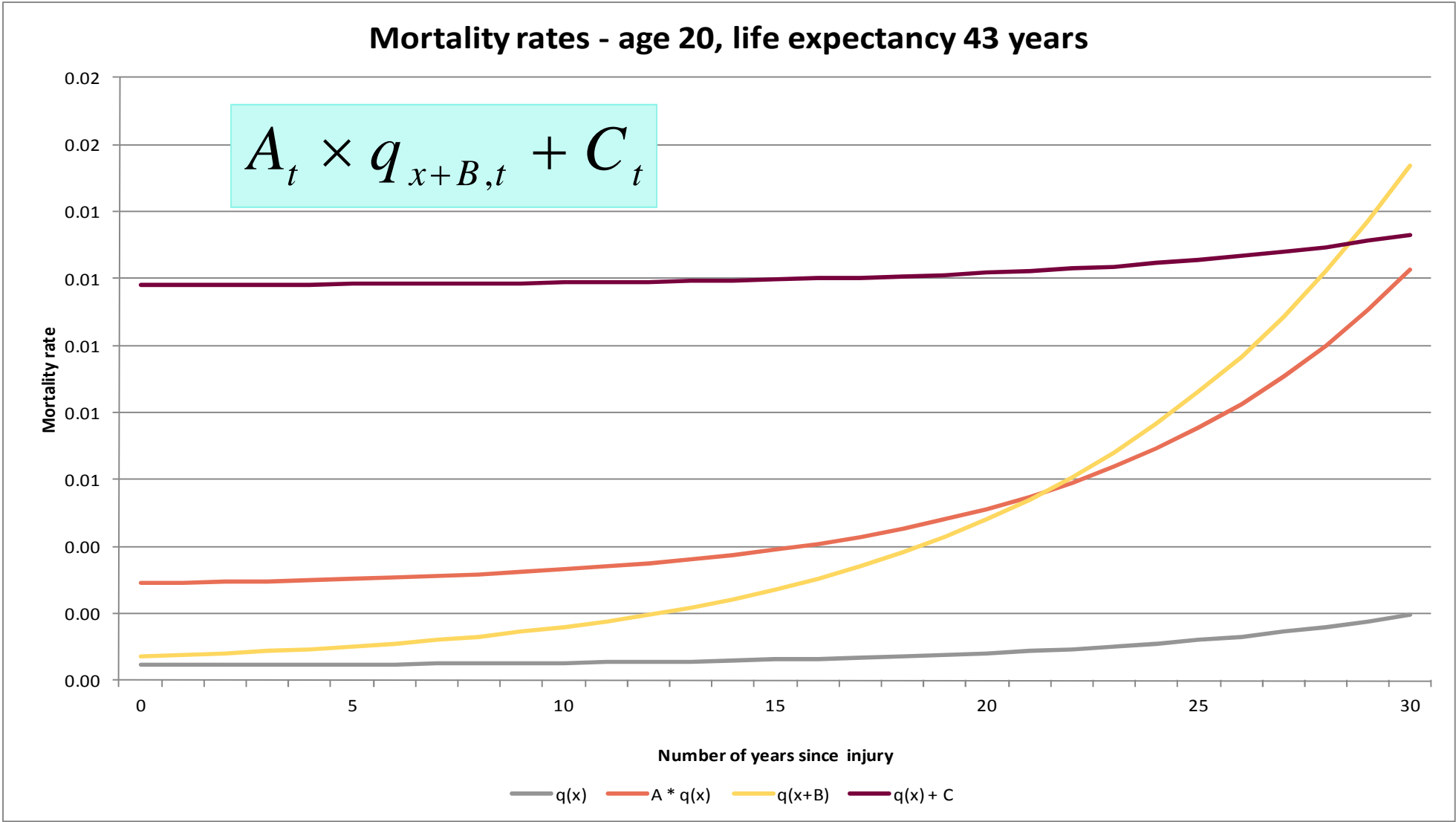
No evidence that time since accident has a significant impact*

* But not enough data to define shape of mortality curve

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Life impairment adjustments

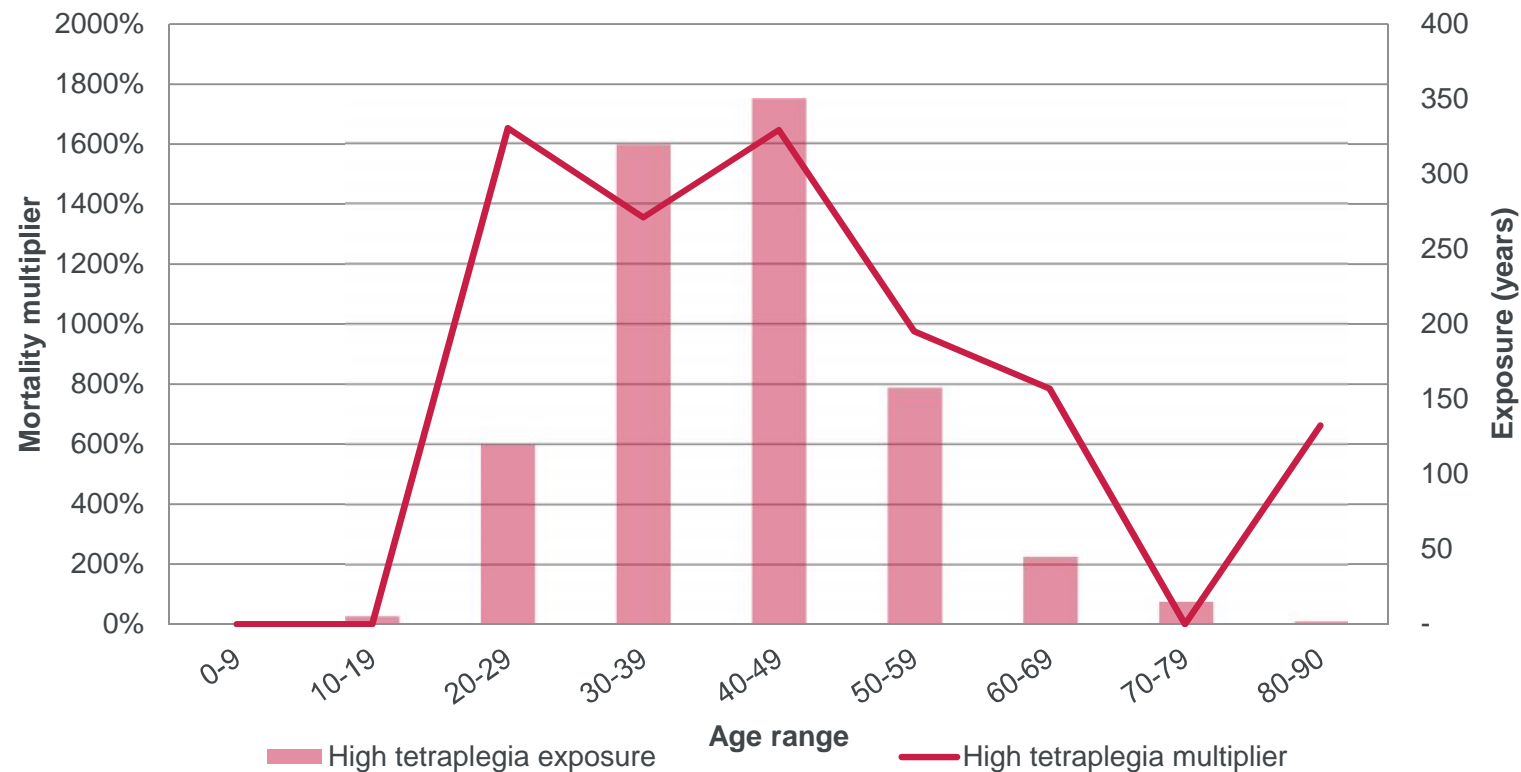


Which adjustment method to use?

- Actual mortality rate compared to expected based on whole population mortality rates
 - Actual to expected q_x ratio - multiplier
 - Actual minus expected q_x - additive

Which adjustment method to use?

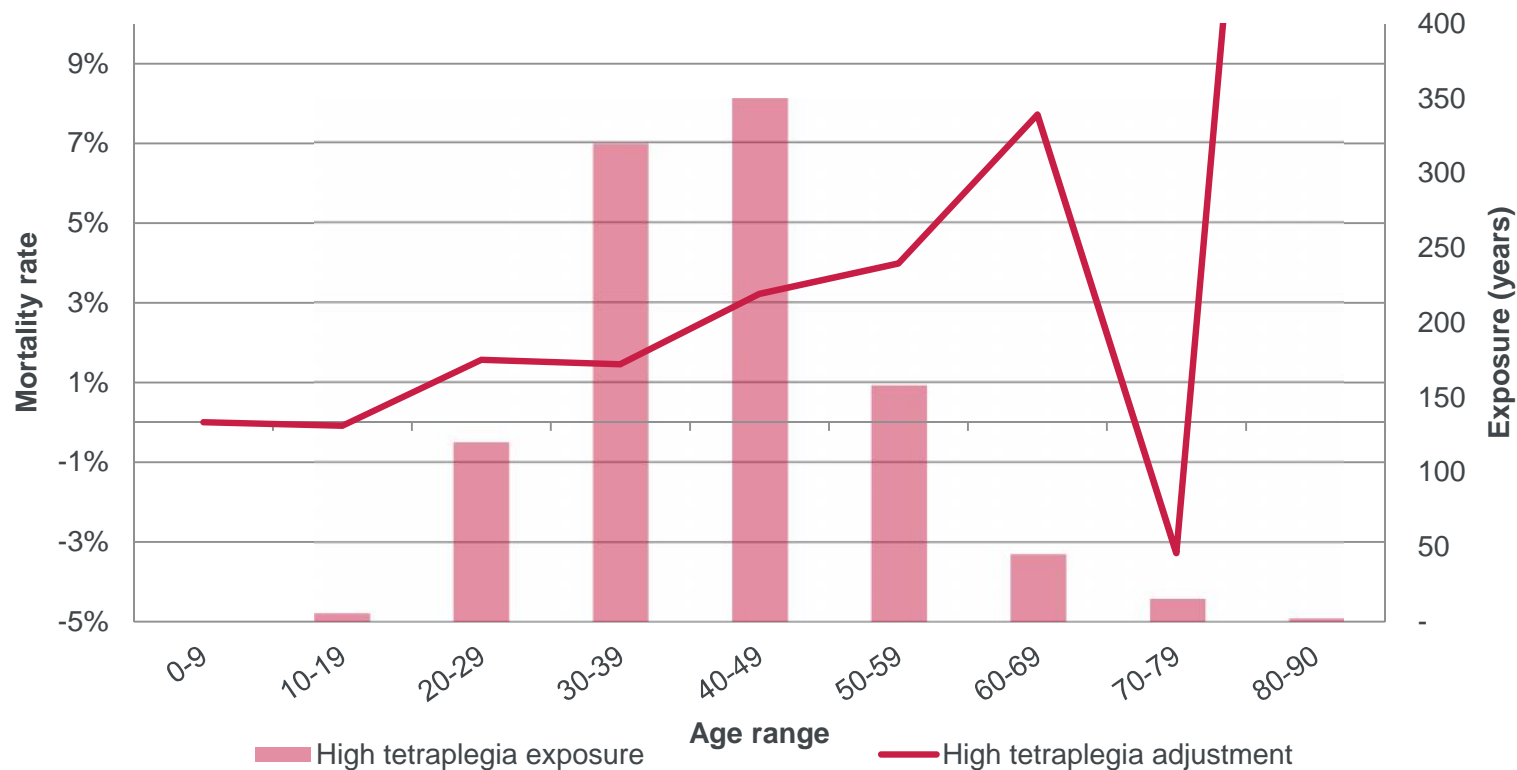
Multiplier - High tetraplegia spinal injury



New Zealand findings

Which adjustment method to use?

Additive - High tetraplegia spinal injury



New Zealand findings

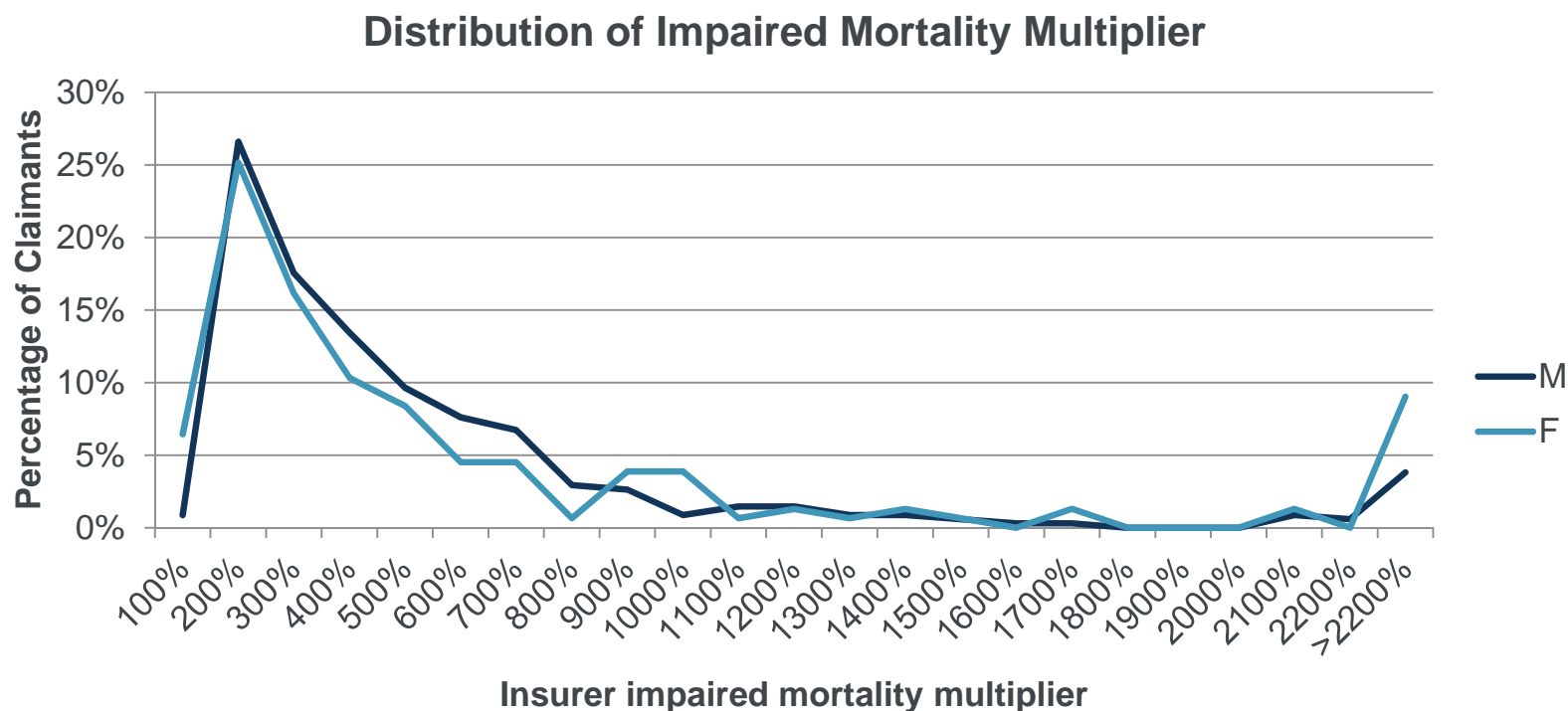
Analysis - limitations

- Limited data
- Model error
 - assumption of homogeneous lives
 - smoking, lifestyle, health before accident...
 - assumption of impairment adjustment
 - constant multiplier to q_x
- Advances in medical science
- UK insurers use specific information about the claimant based on expert opinions

Mortality

Industry recorded rates

- Note the tail



- Industry estimates will reflect differences in base health between individuals

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- How to use this information

Interpretation of results – Take care!

- male claimant multipliers

| Male claimant multipliers | UK | NZ | Victoria |
|---------------------------|-----|-----|----------|
| Overall | 3.3 | 3.8 | 3.0 |

- Differences between territories
 - Care provision
 - Nature of injuries
 - Death rates
 - Compensation structure/process
- Small sample sizes
 - lots of questions!

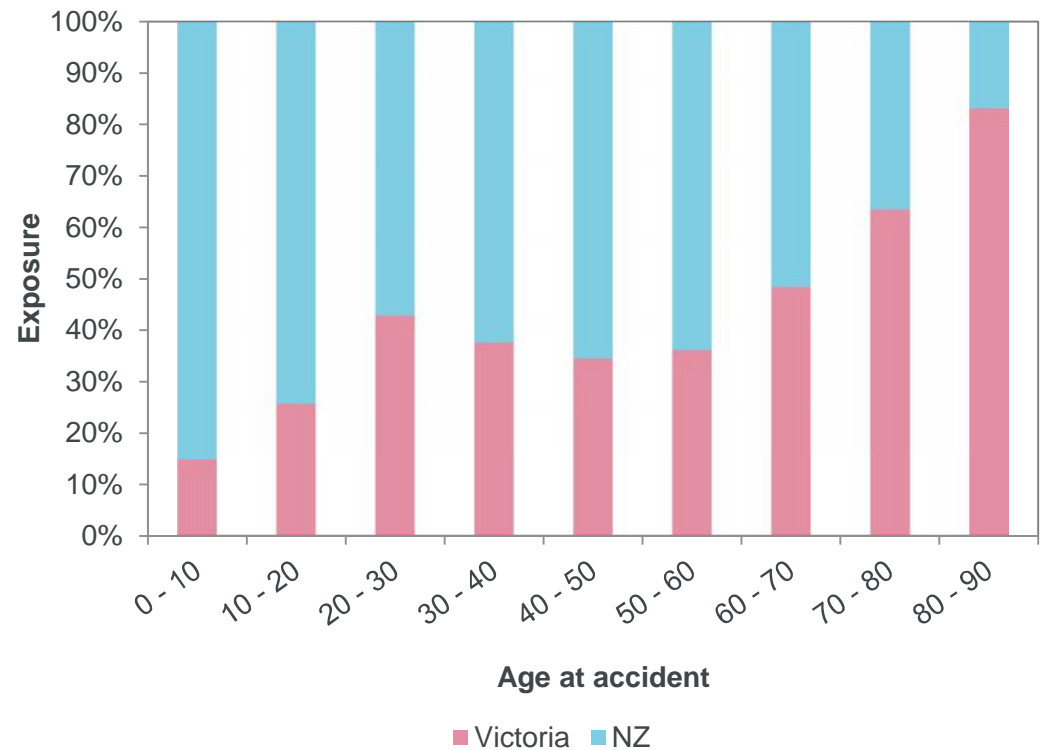
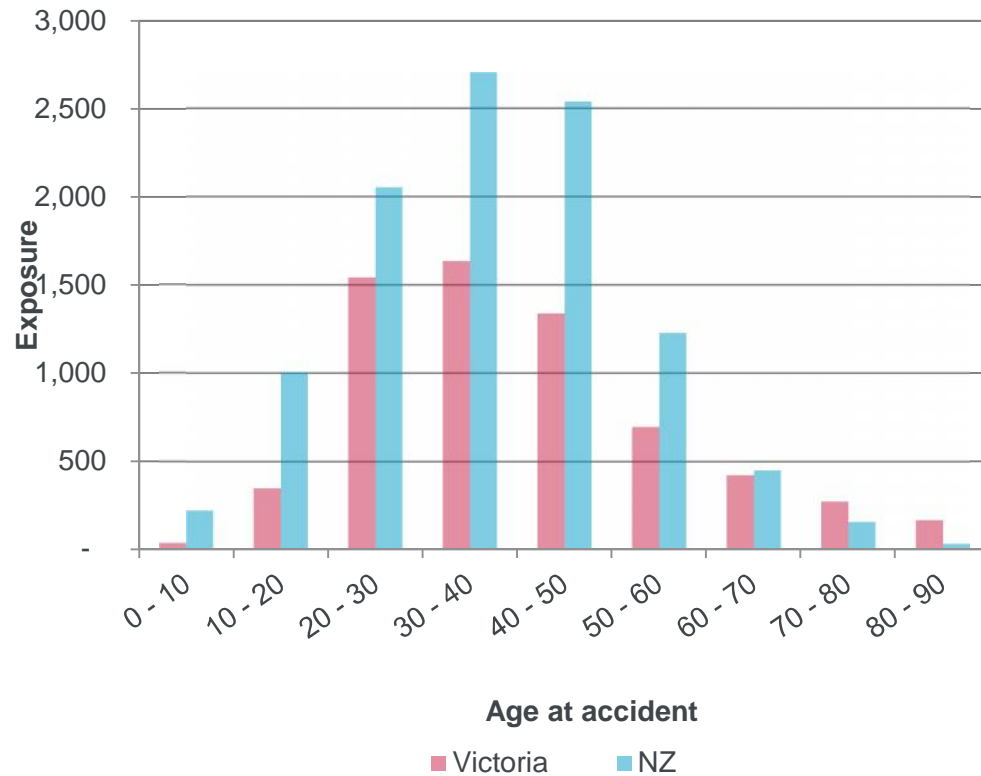
Interpretation of results – Take care!

- male claimant multipliers

| Male claimant multipliers | UK | NZ | Victoria |
|---------------------------|-----|-----|----------|
| Overall | 3.3 | 3.8 | 3.0 |
| | | | |
| Brain | ? | 3.5 | 2.7 |
| Spinal | ? | 4.3 | 5.4 |

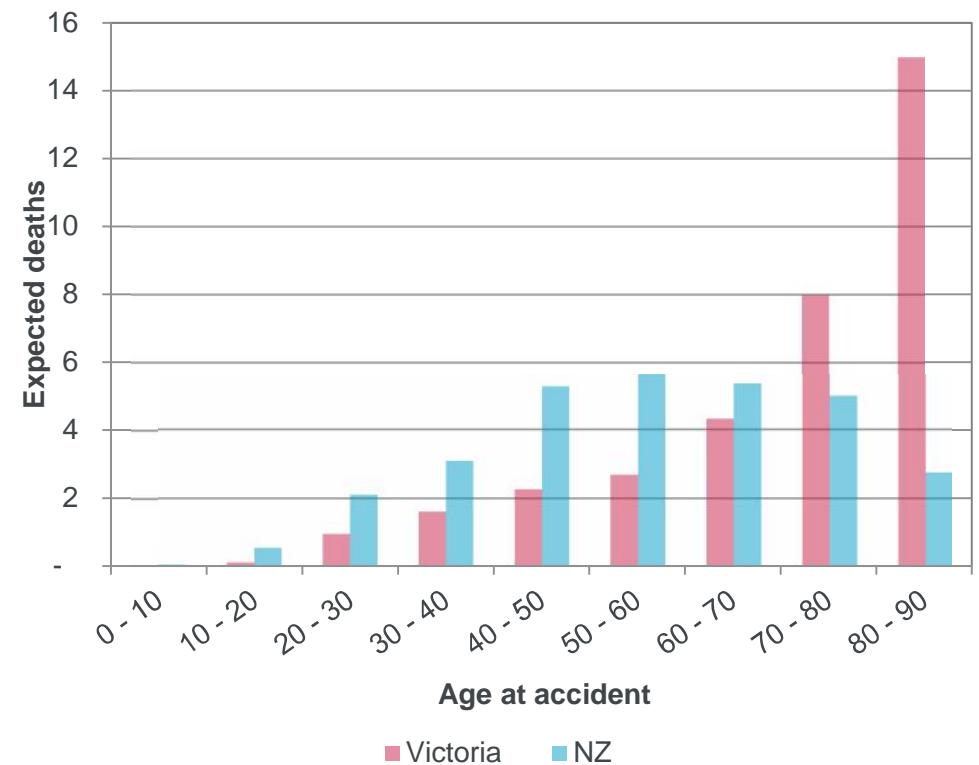
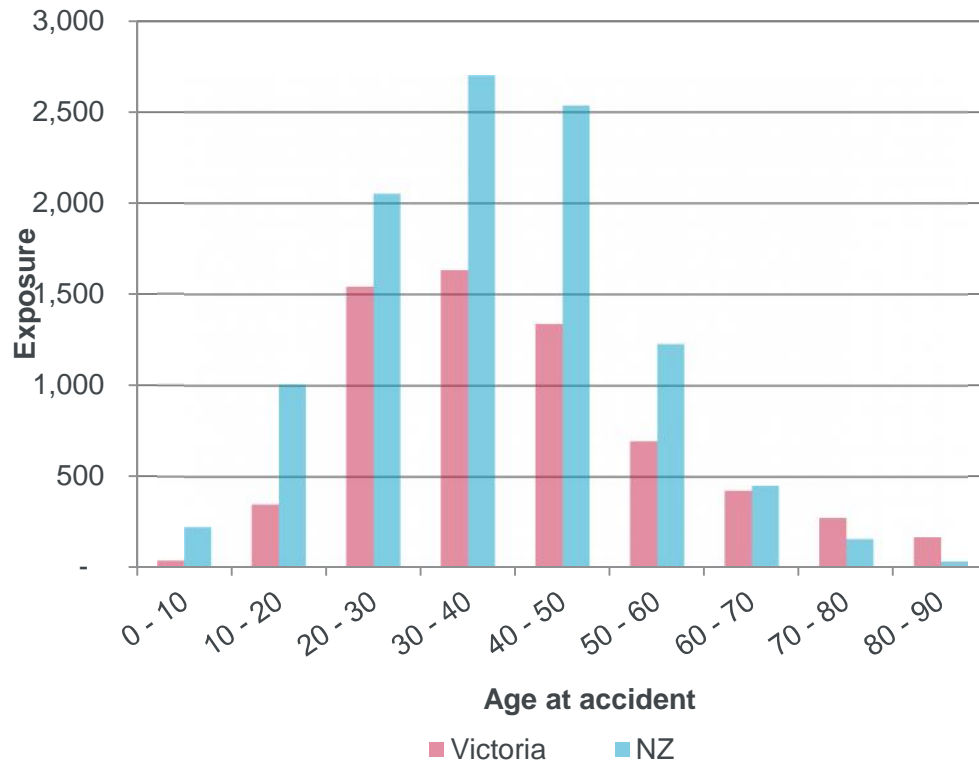
Male brain claimants

- exposure



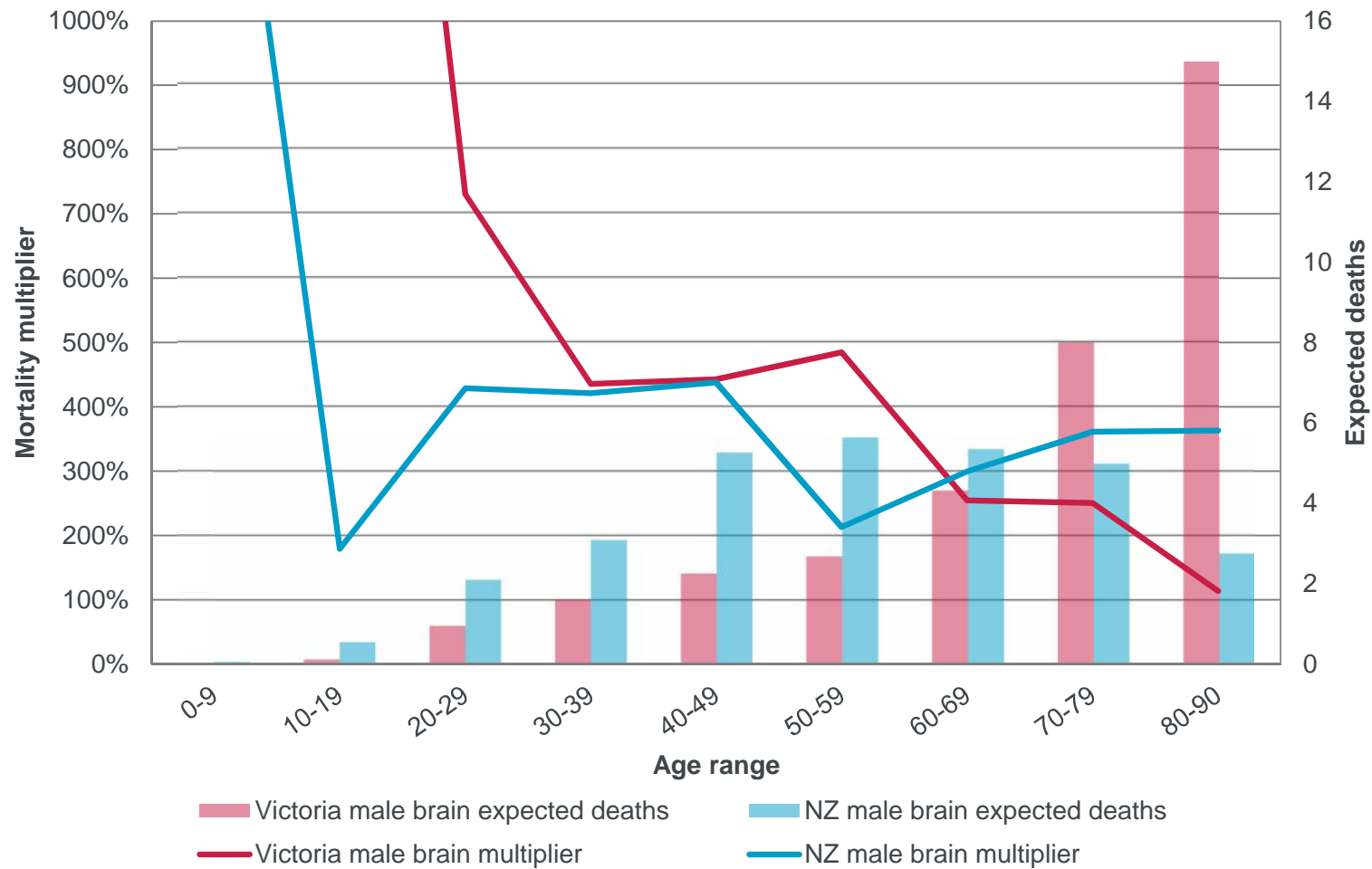
Male brain claimants

- expected deaths



Male brain claimants

- expected deaths and multipliers



Interpretation of results – Take care!

- male claimant multipliers

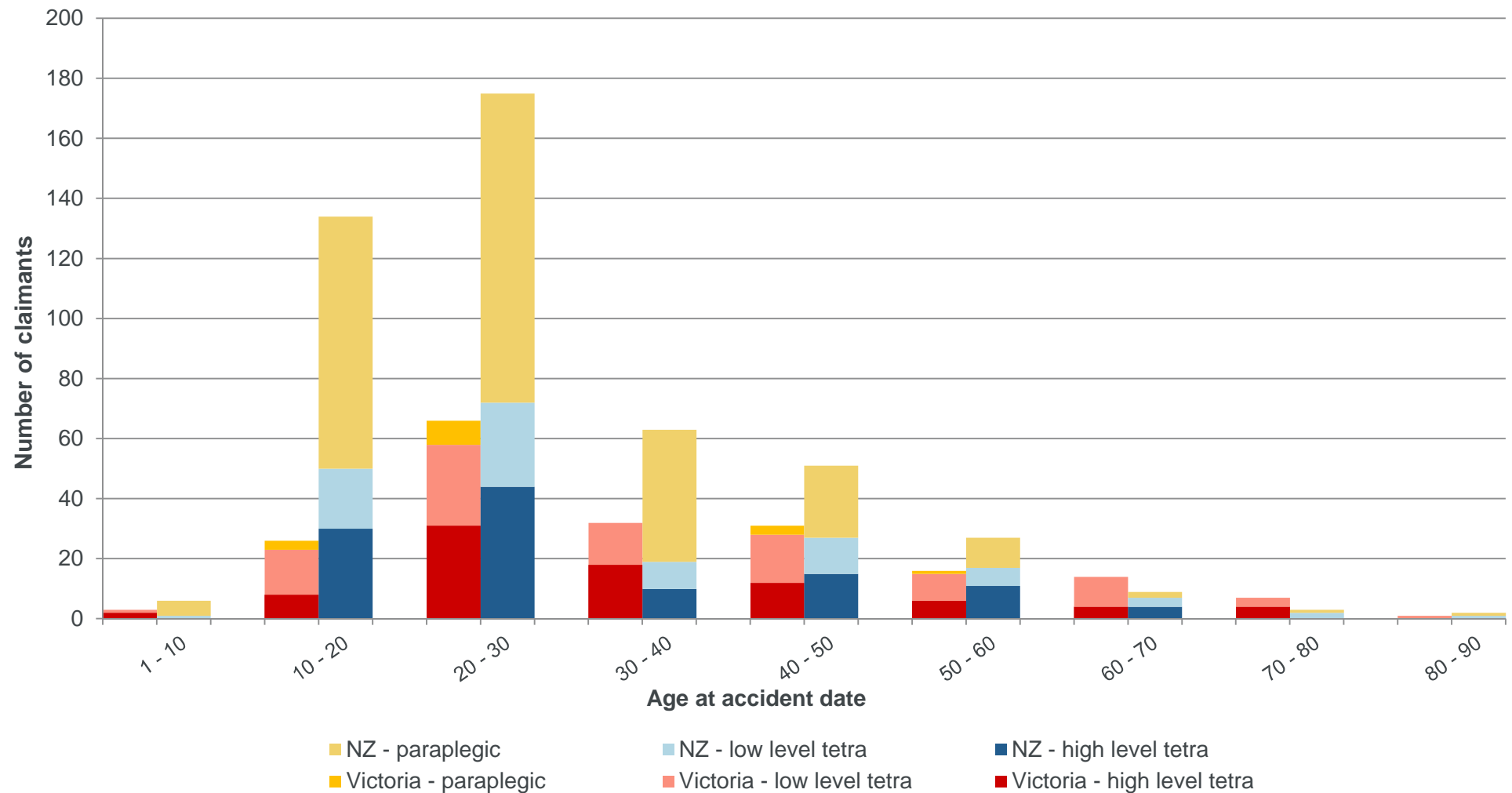
| Male claimant multipliers | UK | NZ | Victoria |
|---------------------------|--------------|-----|----------|
| Overall | 3.3 | 3.8 | 3.0 |
| | | | |
| Brain | ? | 3.5 | 2.7 |
| Spinal | ? | 4.3 | 5.4 |
| | | | |
| Brain – severe | Not recorded | 5.0 | 3.7 |
| Brain - moderate | Not recorded | 2.4 | 1.9 |

Interpretation of results – Take care!

- male claimant multipliers

| Male claimant multipliers | UK | NZ | Victoria |
|---------------------------|--------------|-----|----------|
| Overall | 3.3 | 3.8 | 3.0 |
| | | | |
| Brain | ? | 3.5 | 2.7 |
| Spinal | ? | 4.3 | 5.4 |
| | | | |
| Brain – severe | Not recorded | 5.0 | 3.7 |
| Brain - moderate | Not recorded | 2.4 | 1.9 |

Male spinal injury claimants - split by severity



Male spinal claimants

- expected deaths and multipliers



Contents

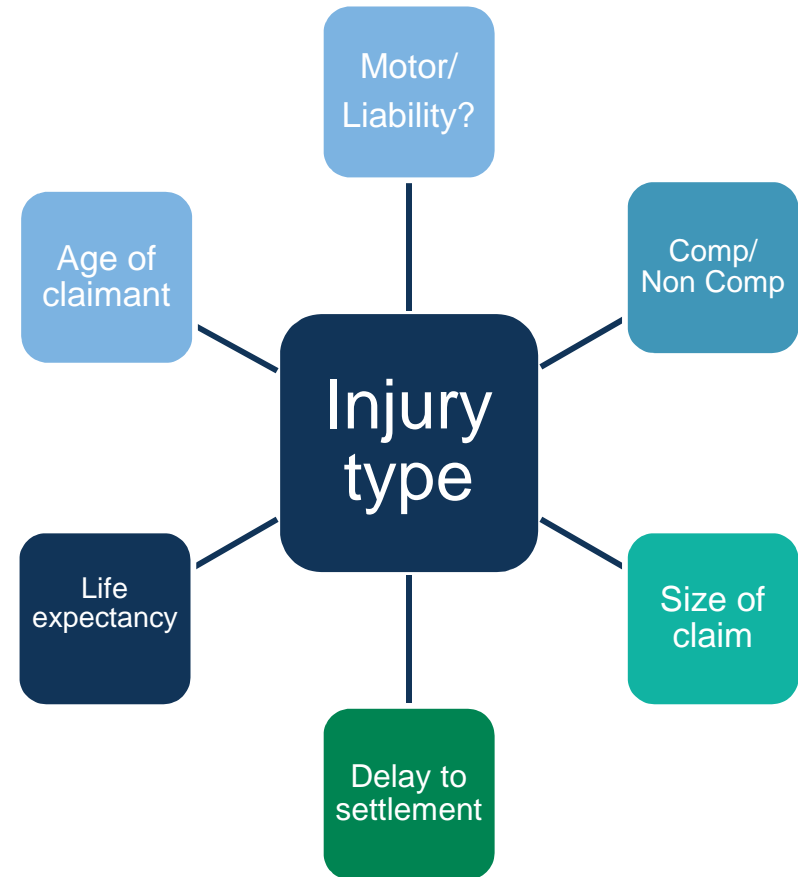
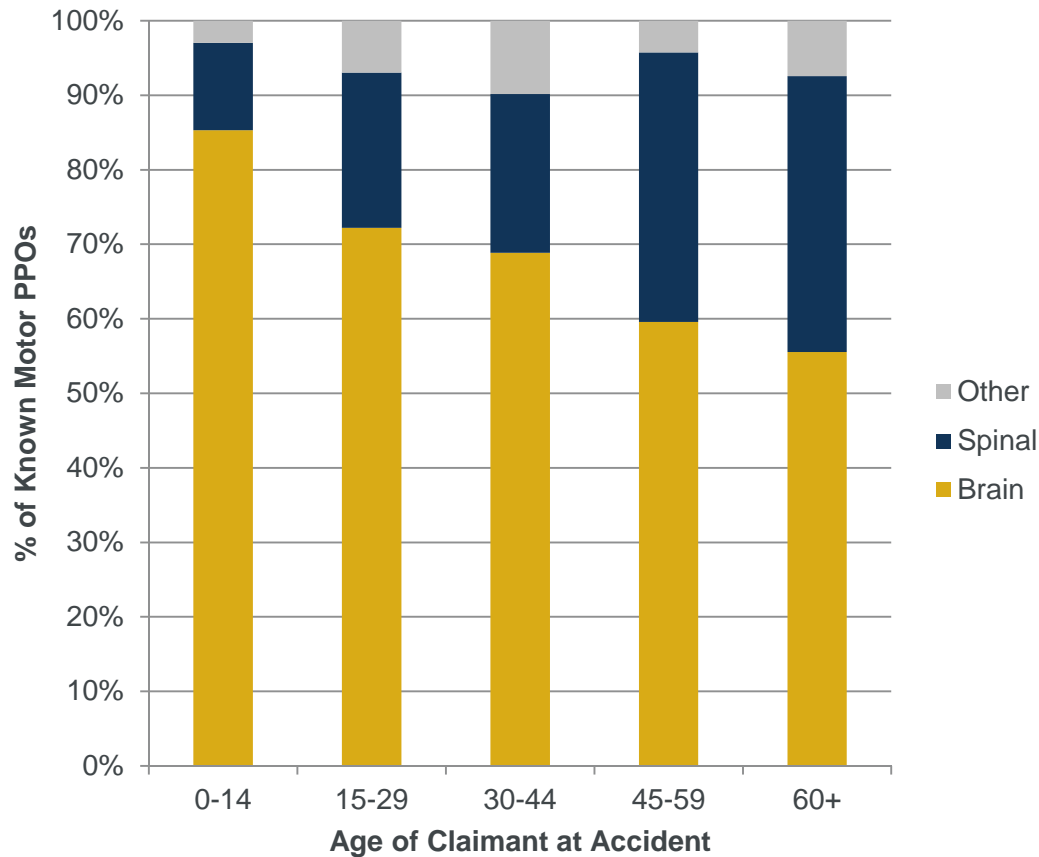
- Country comparisons
- Findings
 - High level conclusions
 - Investigation details
 - Interpretation of results – take care!
- How to use this information

So what to do with this?

- Sense check: Compare your life expectancy estimates against benchmark distributions
- Methodology: How are you adjusting for life impairment?
- Scenarios

Mortality matters?

UK correlation of injury type by claimant age

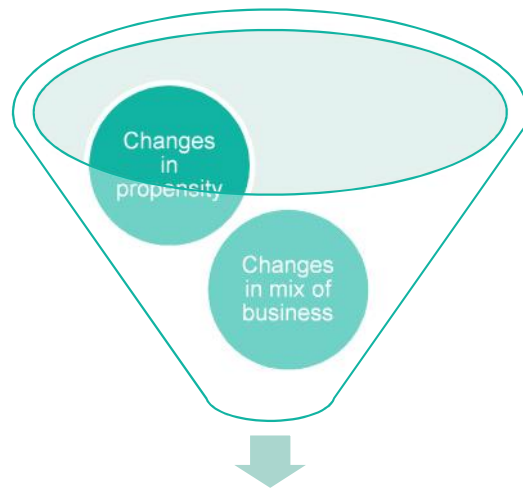


So what to do with this information? Model!

“Sometimes it’s a little better to travel than to arrive”

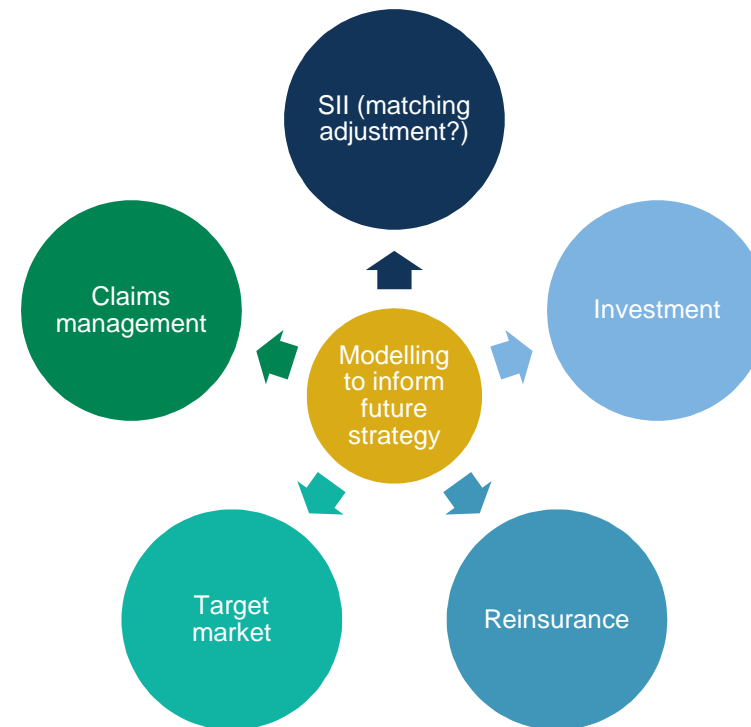
Robert M. Pirsig, *Zen And The Art Of Motorcycle Maintenance: An Inquiry Into Values*

IBNR/unexpired risk



- Net of reinsurance
- Volatility

Inform future strategy



To conclude

Overall findings

- Spinal injury > brain injury mortality
- Severity of injury is significant
- Multiplier reduces by age
- Time since accident may have little impact

Take heed of exposure mix

- Will be different in your company

Record injury type and severity

- All large claims not just PPOs

A good model is invaluable

Write up

- Available in PPO WP report
 - including lots more information
 - Gender
 - Time since accident
 - Additive adjustment

Mortality *does* matter



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Prospective Reinsurance Options

Reinsurance Recoveries An apology

- The following graphs have been changed since the presentation given, as it was discovered that the discounting was being applied twice

Reinsurance Recoveries Background

- PPO's are risky
- Lots of assumptions
- Differences in risk appetite
- Range of different reinsurance products
- Which one is "*Best*"?

Reinsurance Recoveries Aims



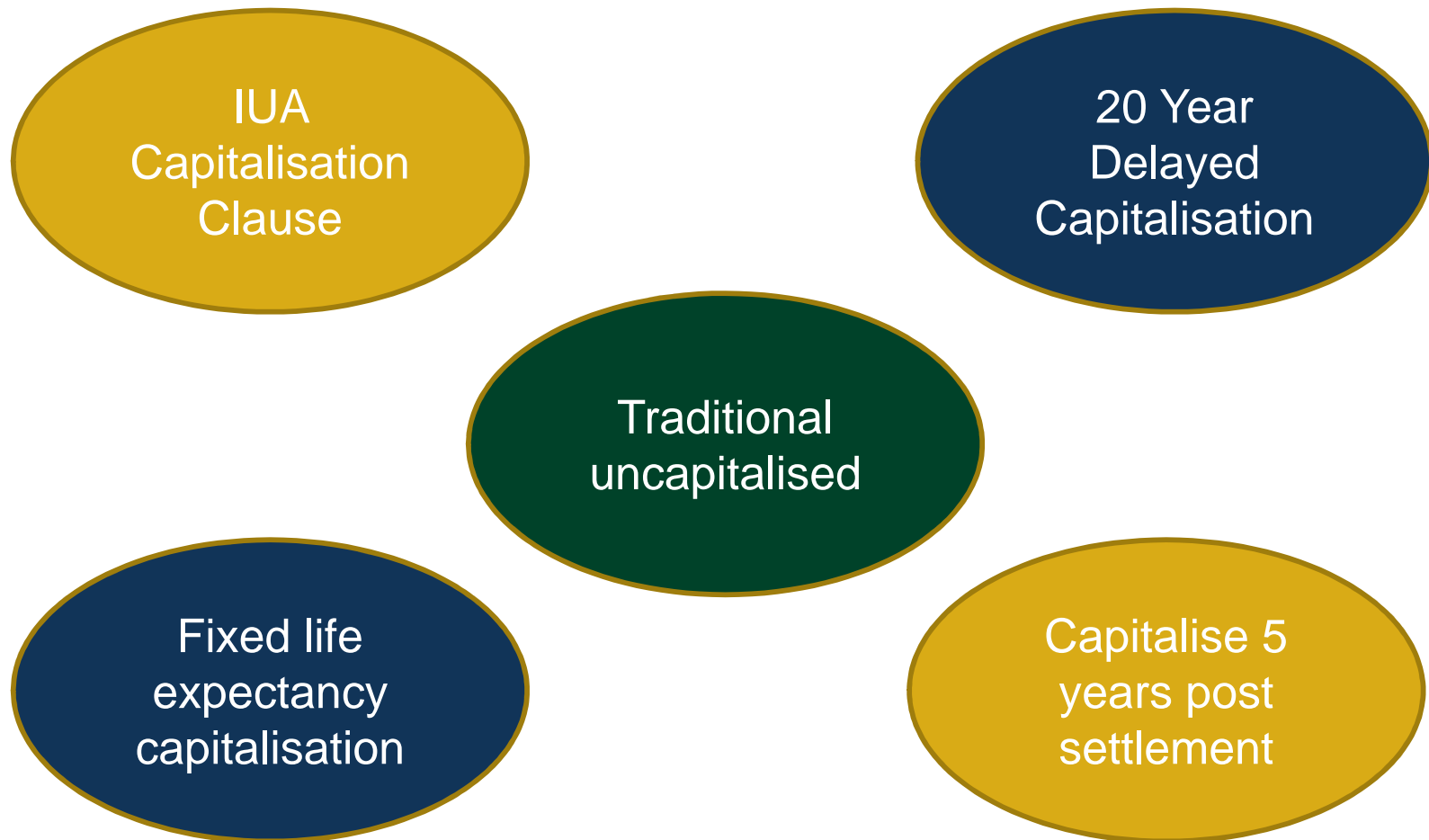
Products

Considerations

Capital
implications

Recoveries

Products



For details, see Appendix

Calculation of reinsurance recoveries

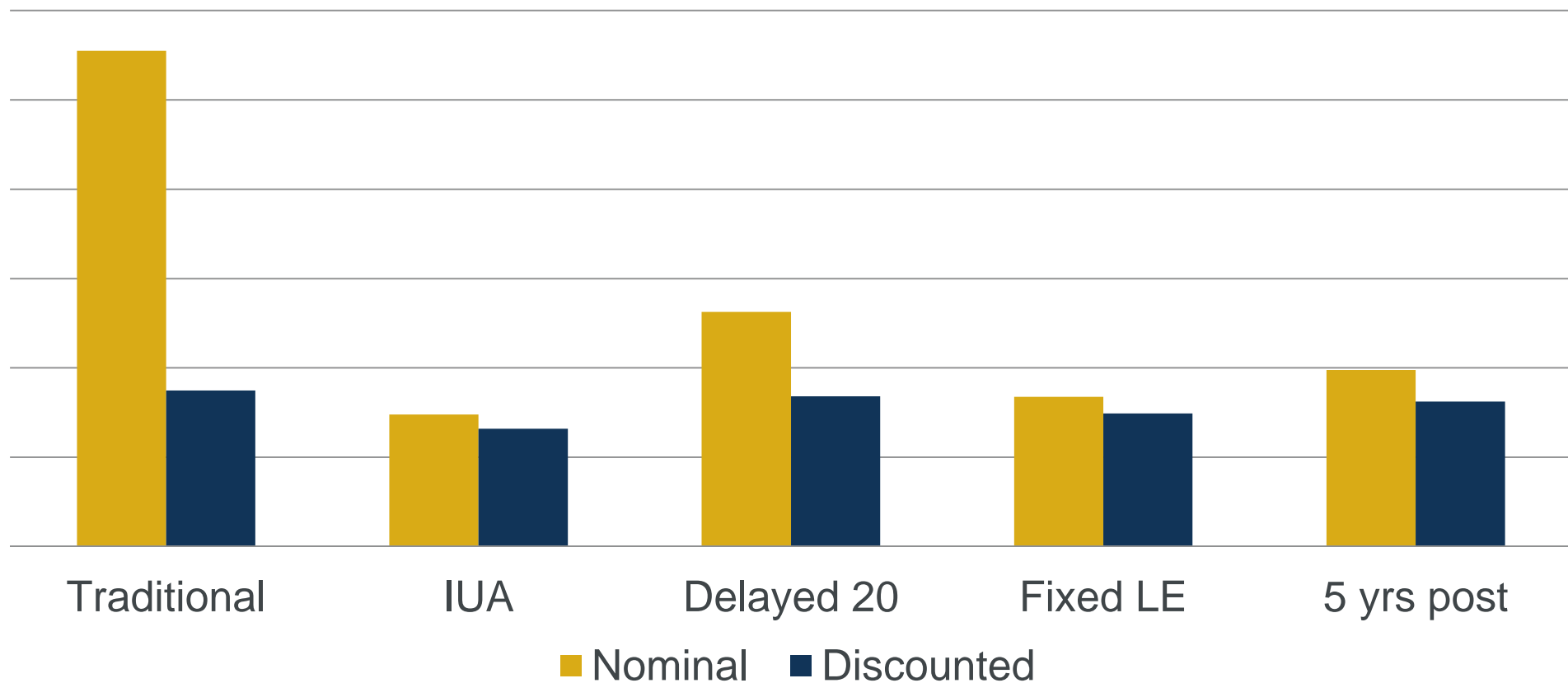
- Some claim scenarios
 - Presented in pricing seminar – see slides
- New results – use survey data
 - convert data to cdf's
 - No assumptions on appropriateness
 - No fitted distributions
- Outputs – 10k simulations
 - Nominal and discounted cashflows
 - Discounted using current government nominal spot rate
 - Mortality uses "rated age" approach

A caveat and reminder

- consciously no numbers as attempting to indicate the relative benefit of the different products
- This is looking at the impact of purchase of reinsurance protecting the prospective business of an insurer, and shows the reserves and the risk margin after the application of the reinsurance recoveries
- We are only looking at large losses here, so the impact on the risk margin of a company would be less than it would appear from these slides as there would be no impact on attritional losses of non proportional reinsurance

Market recoveries under different clauses

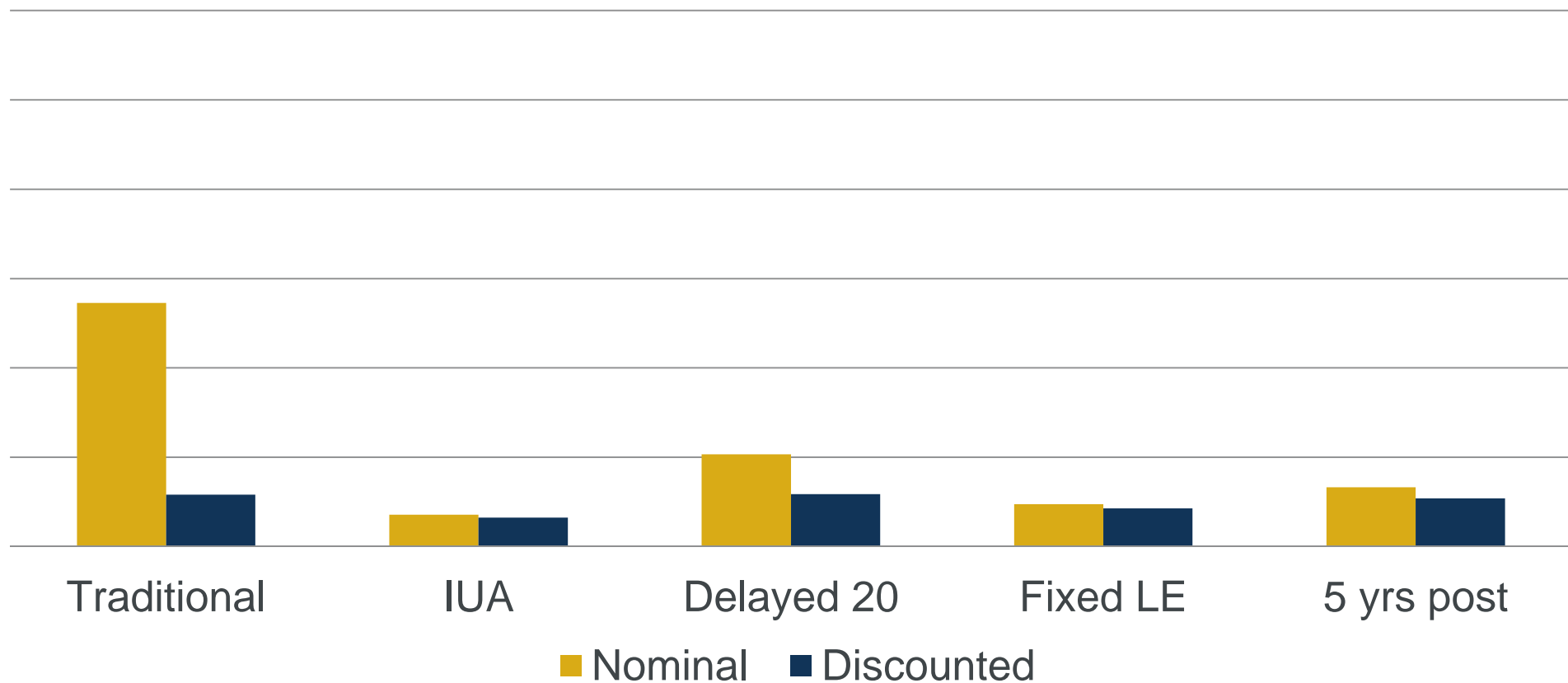
xs £2m



Traditional is the lowest discounted partly due to the shape of the yield curve

Market recoveries under different clauses

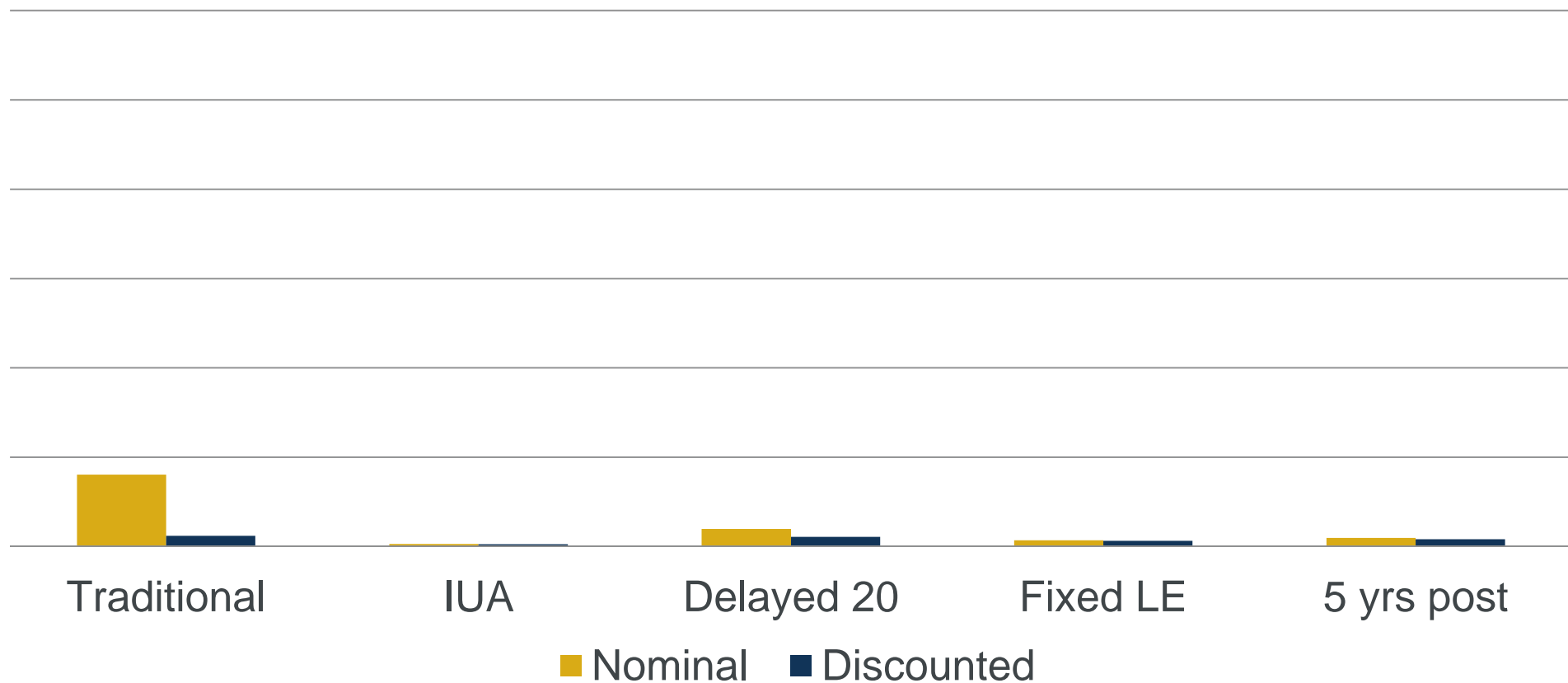
xs £5m



Traditional is the lowest discounted partly due to the shape of the yield curve

Market recoveries under different clauses

xs £10m

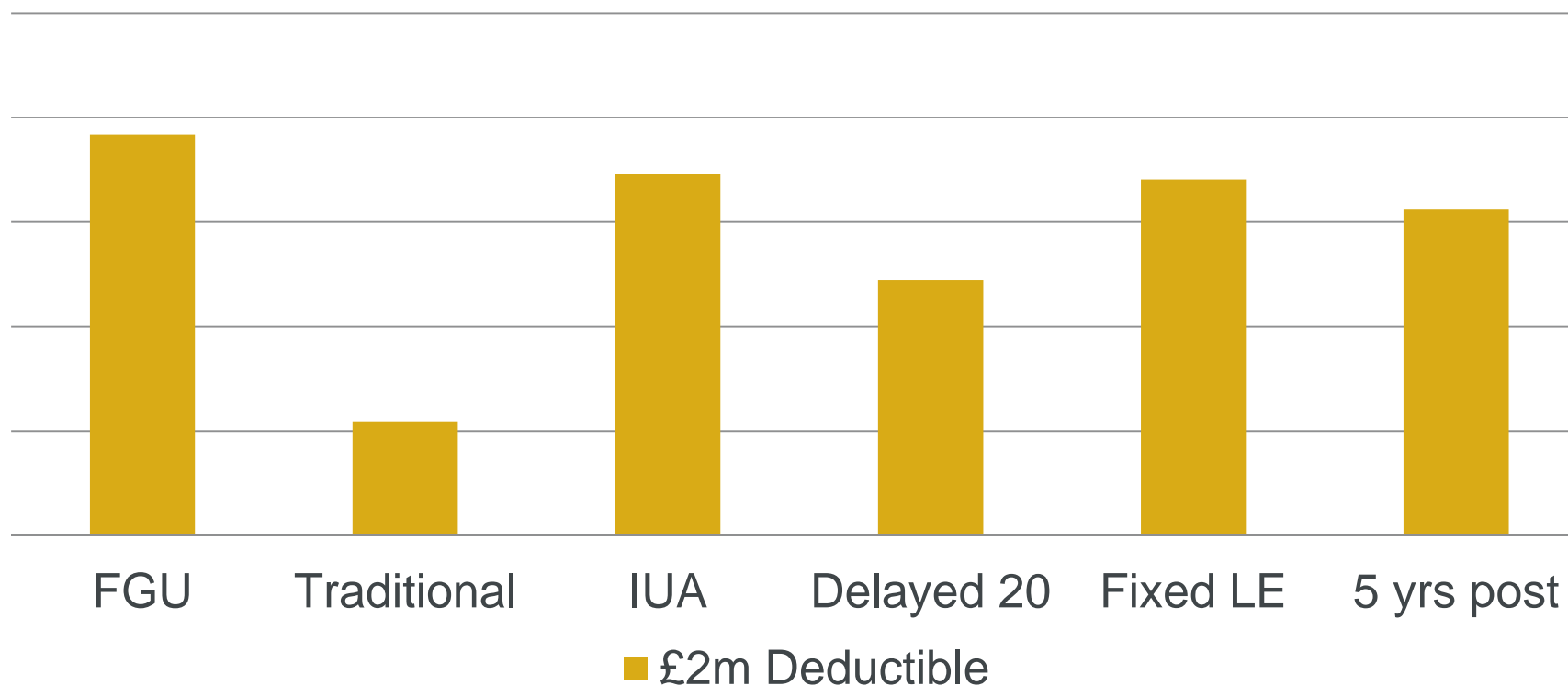


Traditional is the lowest discounted partly due to the shape of the yield curve

Impact on capital

- Not finished
- As yet have focussed on risk margin for losses under standard formula
- Complications with delayed cap and capitalise 5 years post settlement where recoveries are greater than cashflows
- Hence creates an asset so not only affects capital but the solvency as well
- Impact on solvency will in any case depend on the capital already held

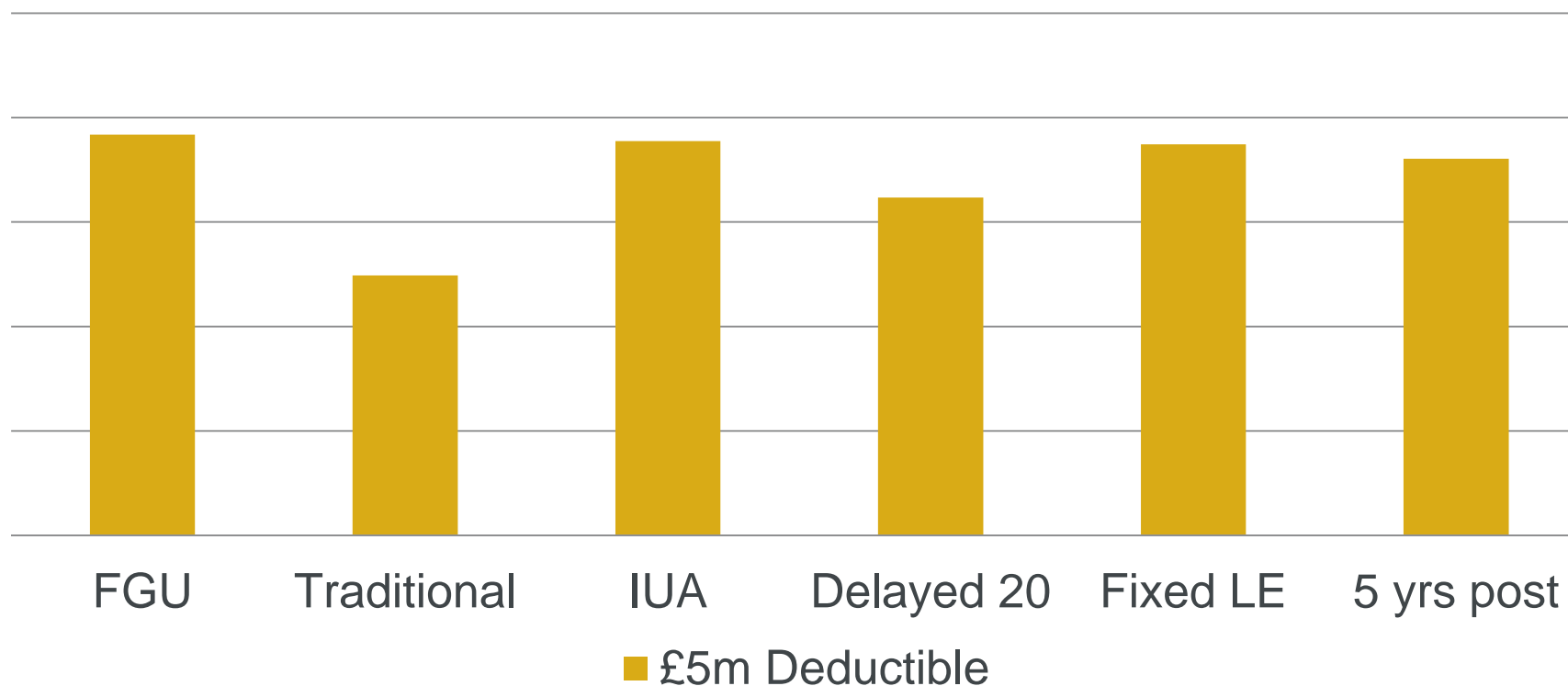
Standard Formula Risk Margin Required



We have calculated risk margin as

- 6% of reserves at each future time period
- discounted to valuation date at risk free rates
- Reserves are future cashflows discounted at risk free rates

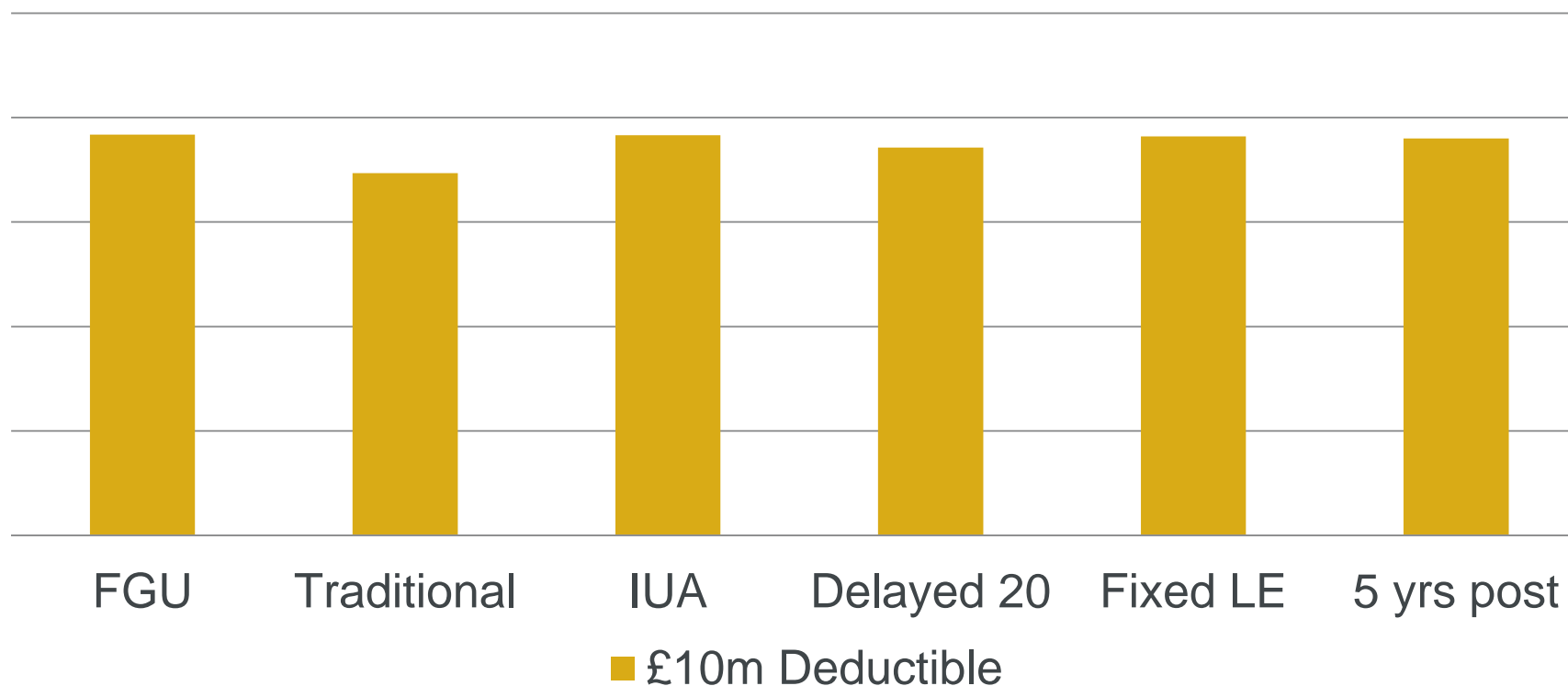
Standard Formula Risk Margin Required



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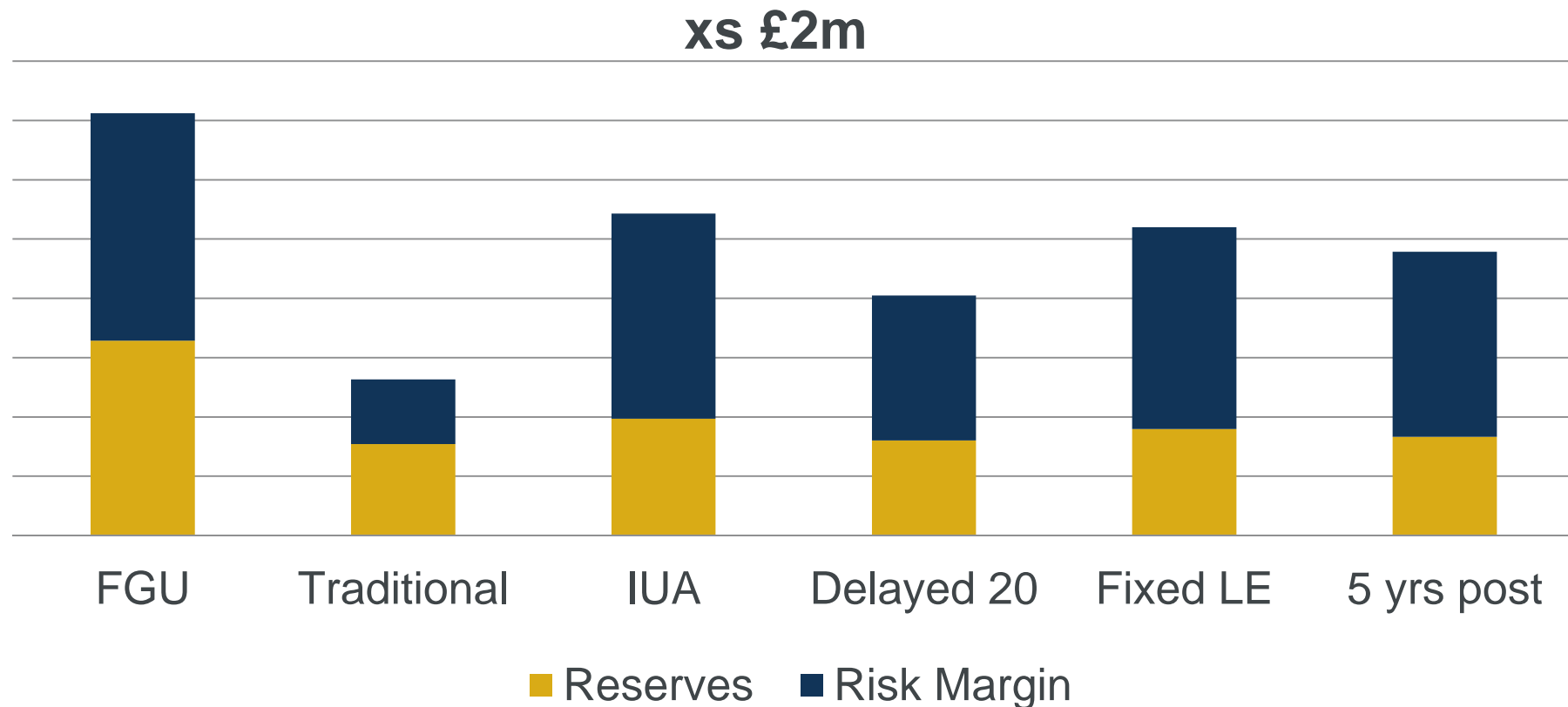
Standard Formula Risk Margin Required



We have calculated risk margin as

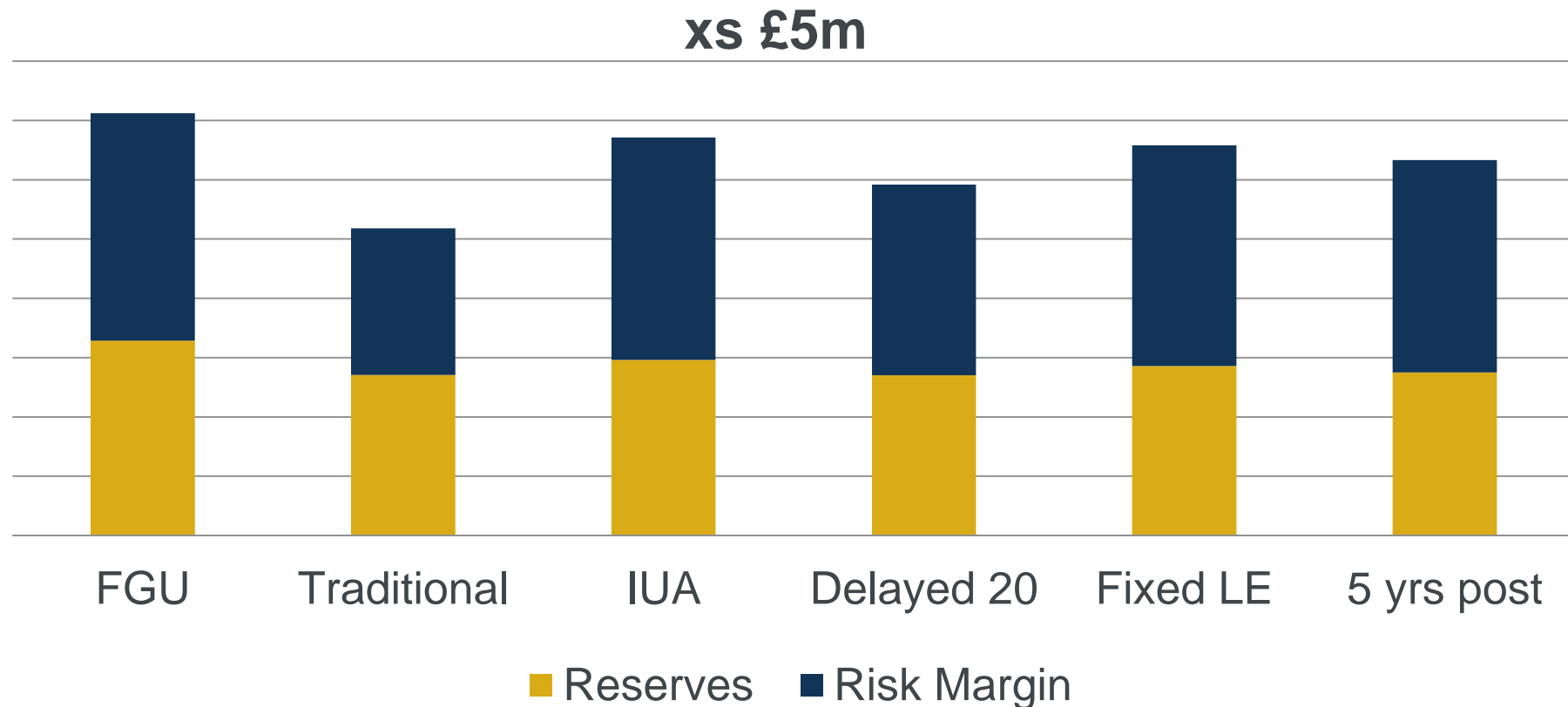
- 6% of reserves at each future time period
- discounted to valuation date at risk free rates
- Reserves are future cashflows discounted at risk free rates

Reserves plus Risk Margin



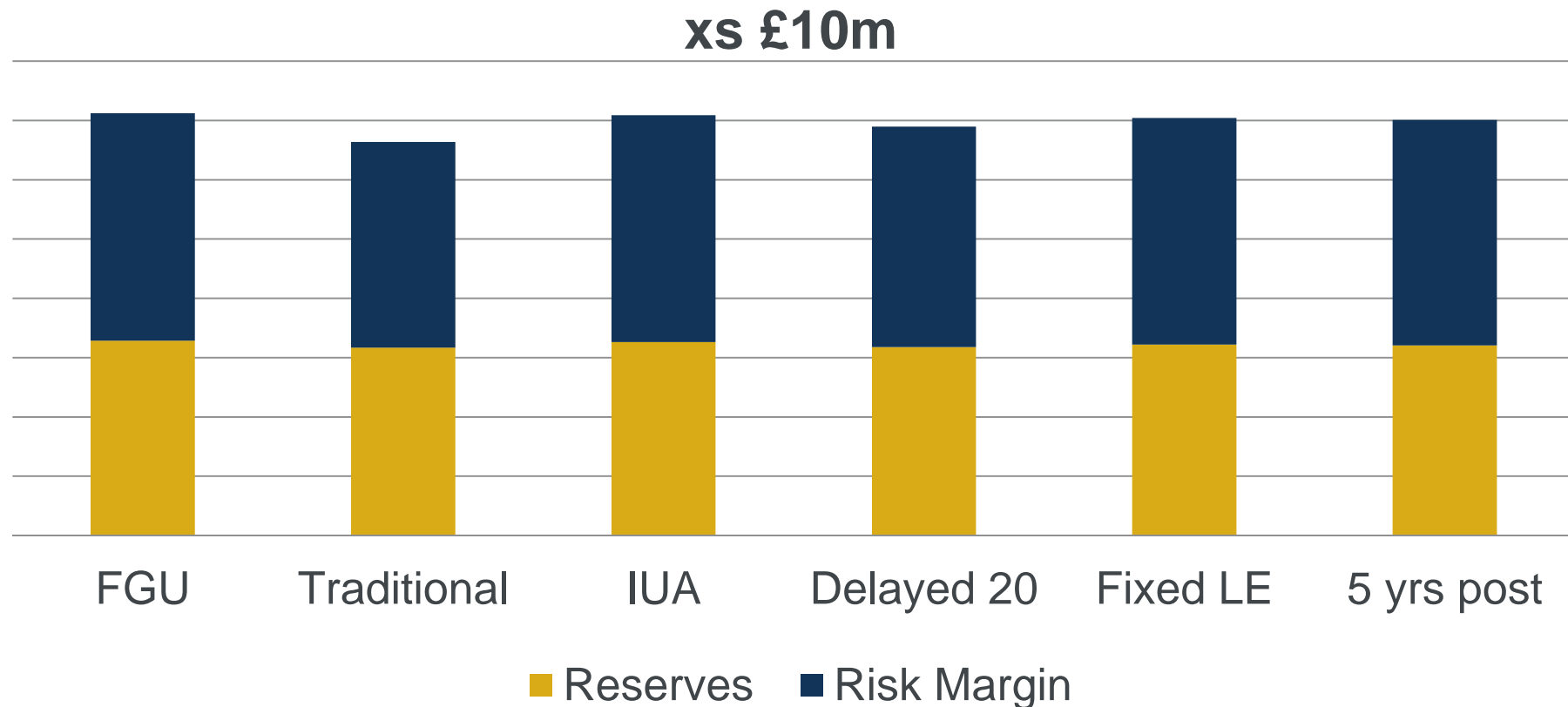
- Net reserves plus risk margin lowest for Delayed cap and 5 years post settlement
- Lower than traditional
- Perhaps says most about the approach to reinsurance in the std formula

Reserves plus Risk Margin



- Net reserves plus risk margin lowest for Delayed cap and 5 years post settlement
- Lower than traditional
- Perhaps says most about the approach to reinsurance in the std formula

Reserves plus Risk Margin



- Level of benefit lower than other deductibles
- similar message in terms of level of risk margin plus reserve relativity

Final considerations 1

- Attritional losses!
- Risk management versus capital
- Internal model vs standard formula vs partial internal model
- What is a 1/200 for PPO's
- How to allow for the assets created
- Future PPO propensity

Final considerations 2

- What is the price of the product
- Security considerations
- Investment strategy
- Discount rate
- Mortality approach/view

etc!!!!

A marketing slide

- For more information see the paper we will release
- Planned for end of the year or early 2015



Questions



Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.

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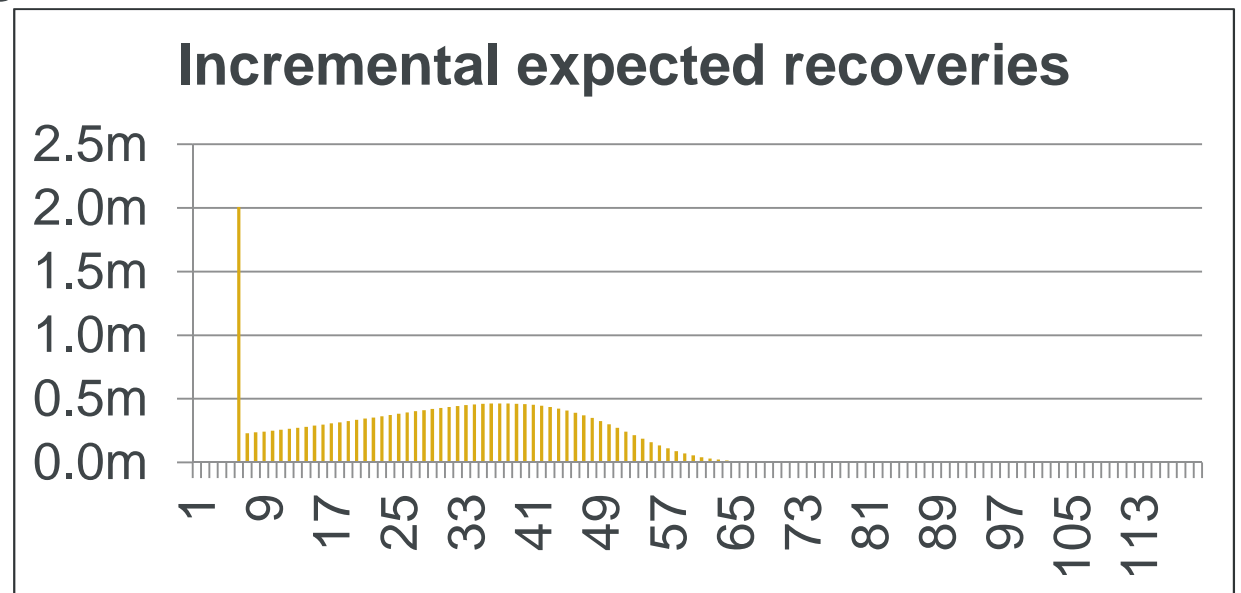
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Appendix

These slides were presented at the pricing seminar and are included as background information

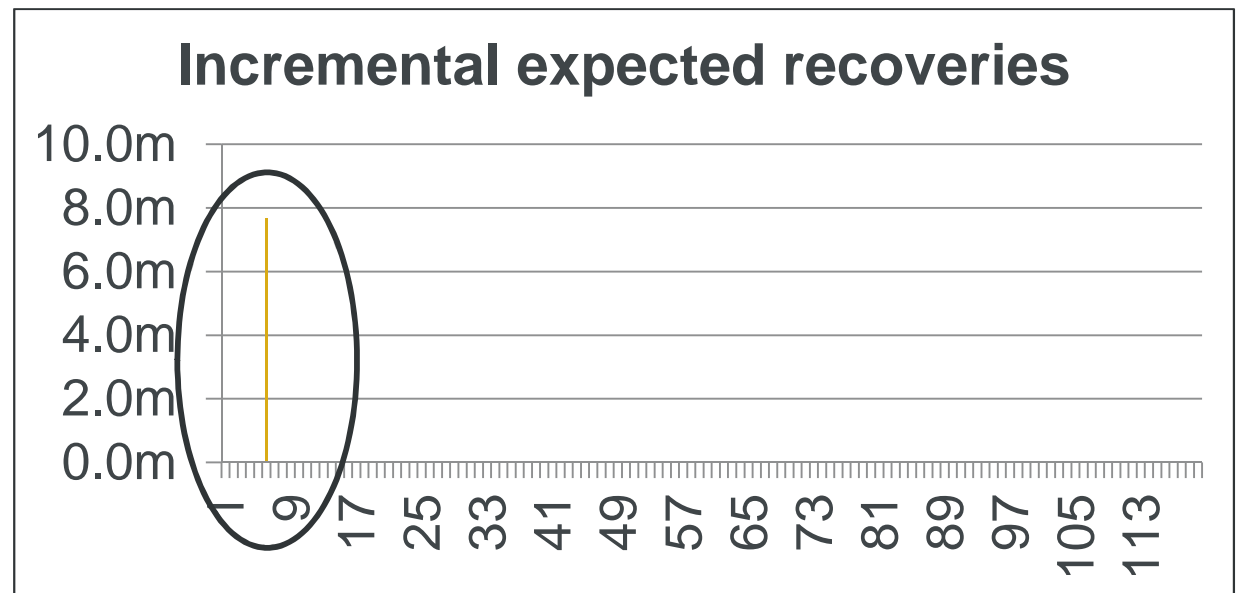
Products: Uncapitalised

- "Pay as Paid"
- Traditional basis
- Includes "deductible creep"
- Recoveries made throughout the lifetime of the claimant
- Well known



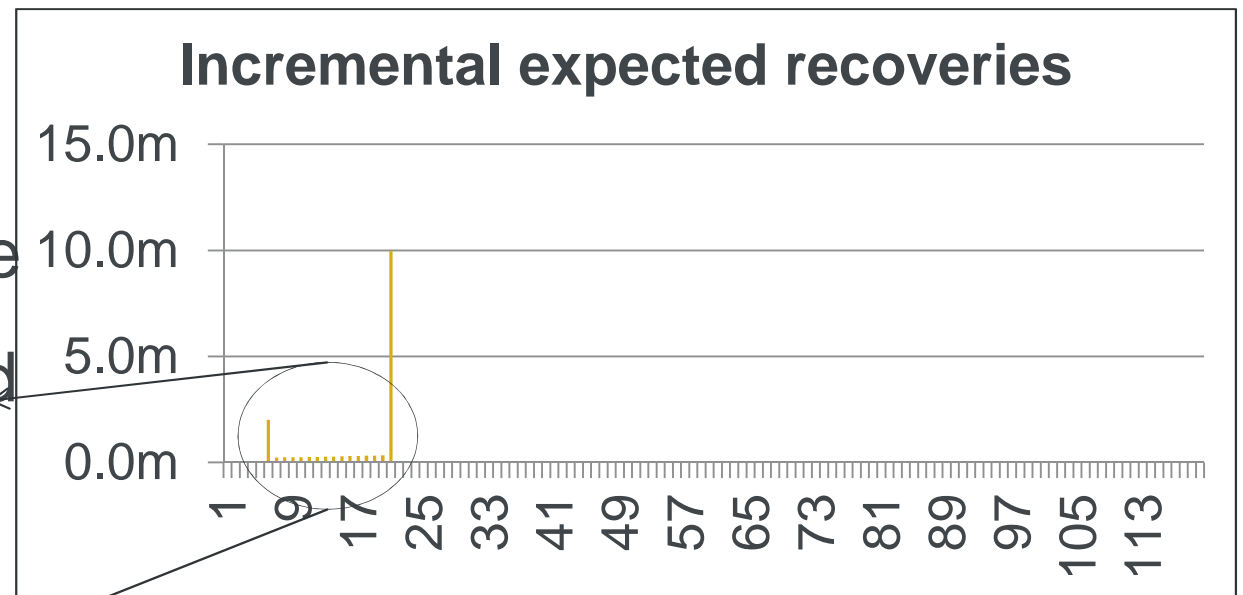
Products: IUA Capitalisation

- Lump sum capitalisation at time of settlement of underlying
- Allows for life impairment
- Intended as settlement as if a lump sum was paid to the original claimant
- Full and final settlement
- We used 1.5% discount



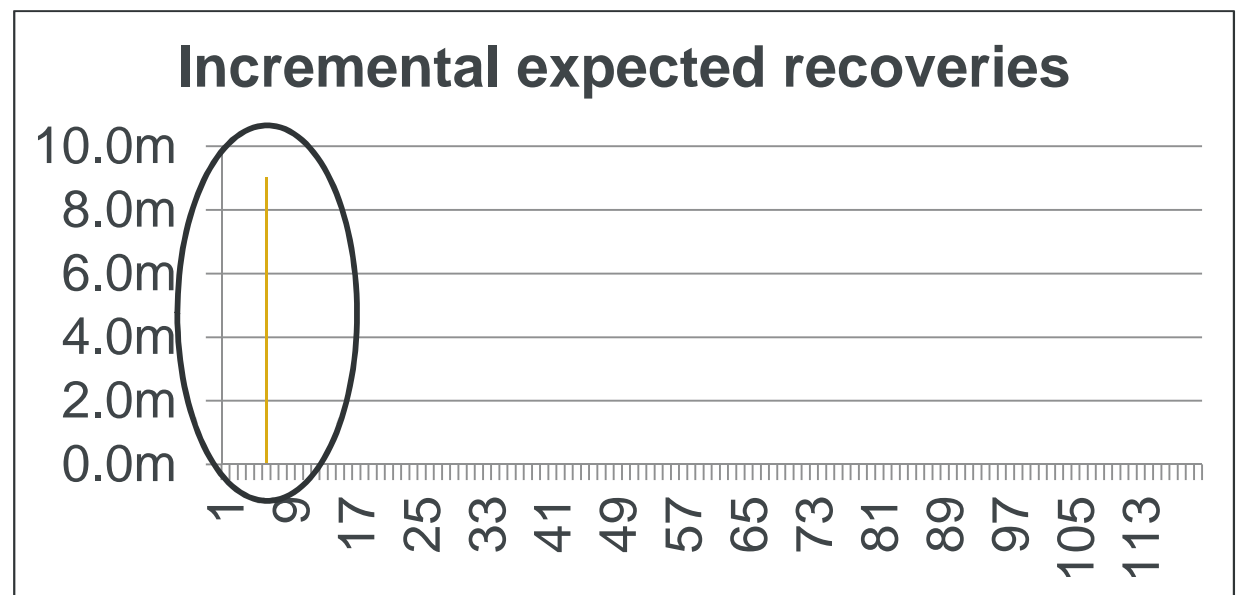
Products: Delayed capitalisation

- "Follow the fortunes" for 20 years
- Lump sum capitalisation 20 years after expiry of reinsurance treaty
- Intended as settlement as if a lump sum was paid to the original claimant
- Full and final settlement
- Used 1.5% discount rate
- No impairment assumed



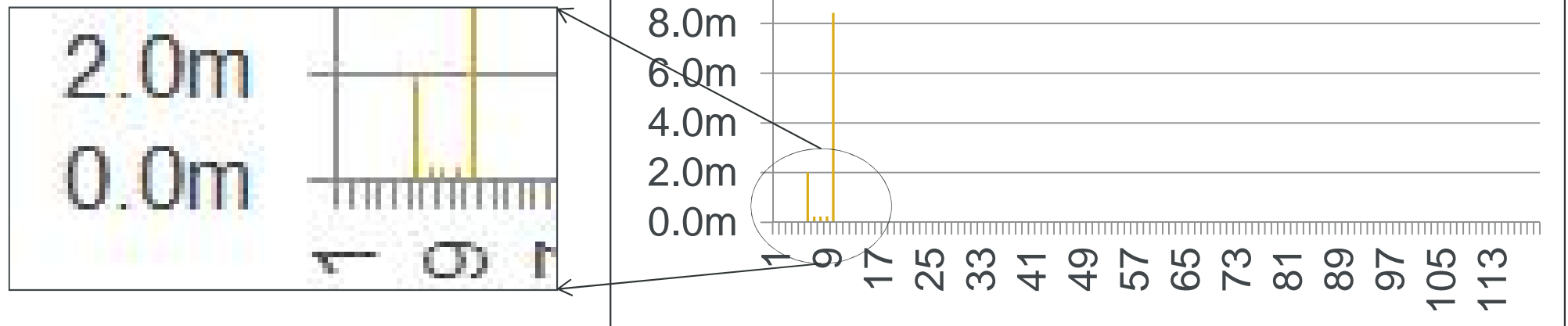
Products: Fixed Life expectancy capitalisation

- Lump sum capitalisation at settlement of underlying claim
- PV of expected recoveries assuming that the claimant lived to expected age of death with 100% probability
- Impairment included based on expert evidence
- Single payment
- Indexed deductible

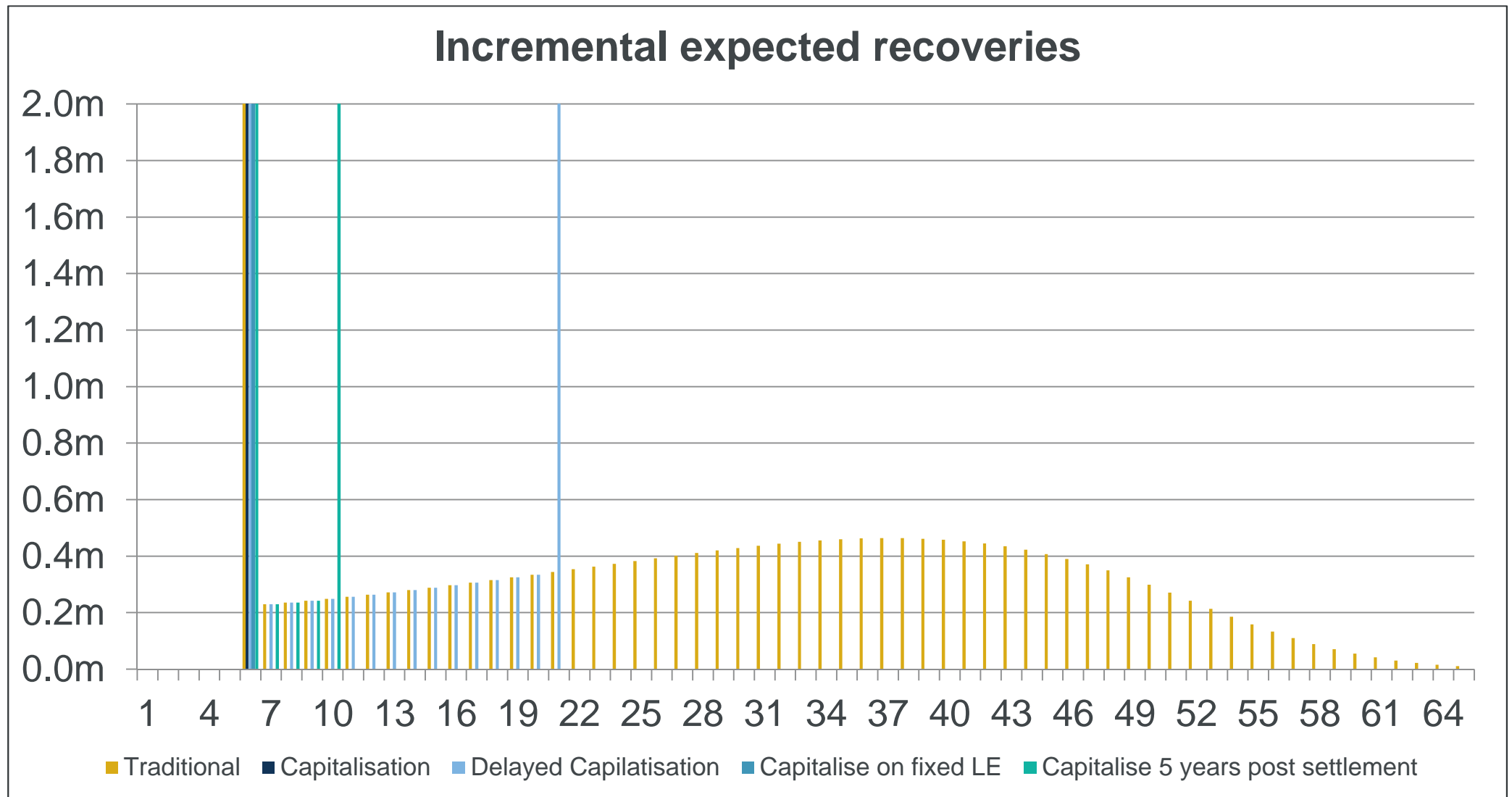


Products: capitalise 5 years post settlement

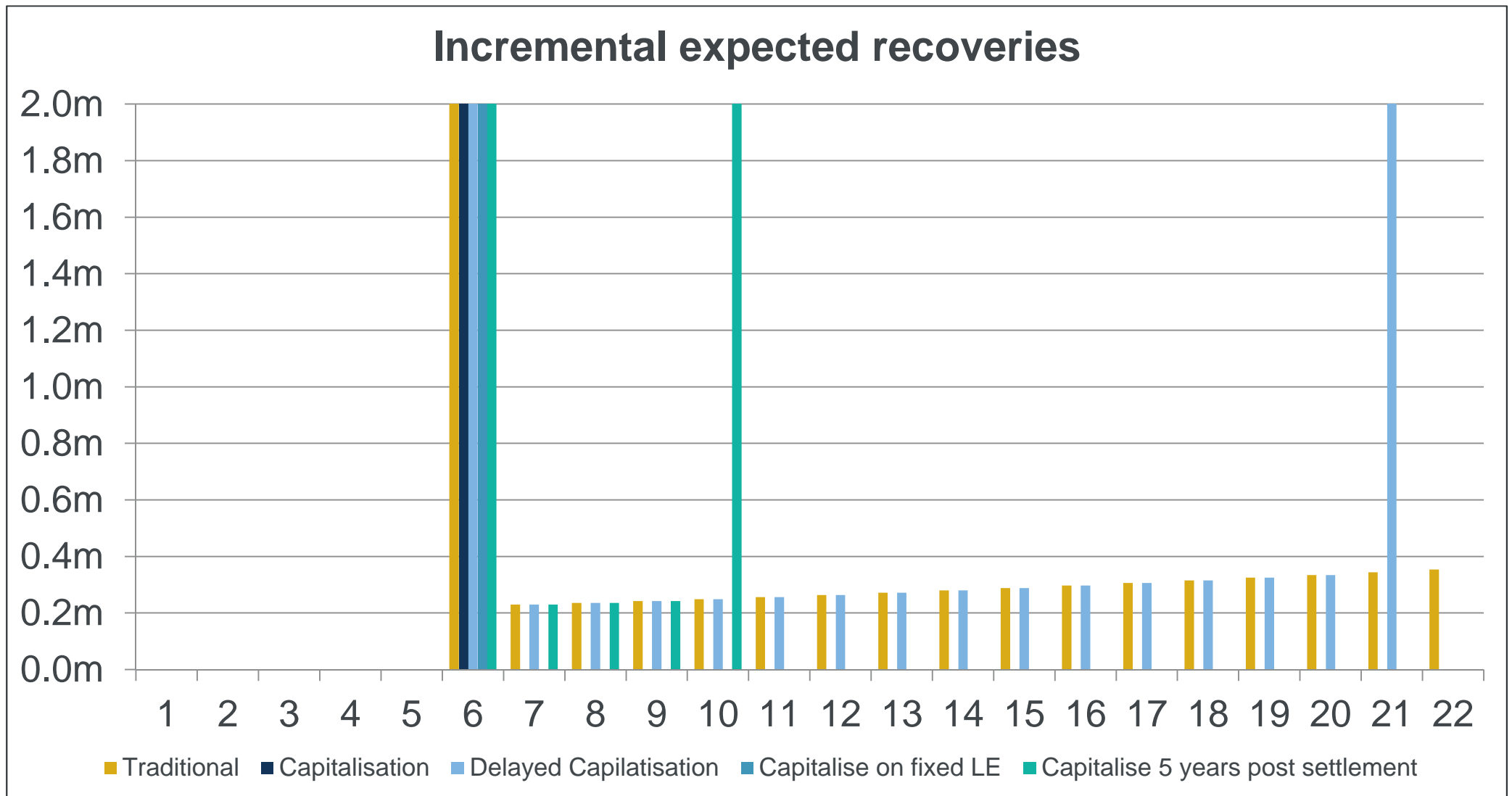
- Lump sum capitalisation 5 years post settlement of underlying claim
- Intended as settlement as if a lump sum was paid to the original claimant
- Fixed 5 year Impairment
- 1% discount rate



Products: All on one graph - Zoomed



Products: All on one graph – Zoomed further



Reinsurance Recoveries - Calculations

- Need some claims scenarios
- Process thus
 - Use bodily injury classification template
 - Choose one of each category of loss (Brain/spinal (complete vs incomplete)/amputation) and a level of care
 - Request impairment and cost for a typical claimant from claims
 - Circulate to WP

Claim scenarios

| Injury Type | Injury Code | "Complete/ Incomplete" | Level of care | Lump Sum | Annual PPO | Age | Impairment (years) |
|-------------|-------------|------------------------|---------------|----------|------------|-----|--------------------|
| Brain | B5 | N/A | +2, 24/7 | £3m | £225k | 30 | 15 |
| Spinal | S2 | Complete | 1-2, 24/7 | £3.75m | £150k | 30 | 20 |
| Spinal | S5 | Complete | Domestic only | £2m | £10k | 30 | 10 |
| Amputation | A3 | N/A | Domestic only | £1.5m | £6.5k | 30 | 0 |

6 year settlement delay

Table © Institute and Faculty of Actuaries, 2014

Reinsurance Recoveries - Calculations

- Simple model created and peer reviewed
 - One claimant
 - No steps
 - IUA/delayed capitalisation 20 simplified by use of Ogden multiplier rather than IUA spreadsheet
 - No variation orders
 - No LoE PPO's

Reinsurance Recoveries – variables

- Assessed the impact of varying certain key inputs
 - Inflation (2%/4%/6% and 4% followed by spike at 25 years (2 years of 20%))
 - Discount rate (2%/4%/6% and real yield)
 - Mortality (Rated-age/additive/multiplicative)
 - Deductible (£1m/£5m/£10m)
- Have shown how the products rank in terms of the PV of recoveries – (1= high, 5 = low)

Reinsurance Recoveries – Tables

- For detail on tables see planned paper later this year

Reinsurance Recoveries – Discounting – rank PV of recoveries

| – 2% | Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|------|--------|-------|-----|----------|----------|---------|
| | £1m | 2 | 5 | 1 | 3 | 4 |
| | £5m | 3 | 5 | 1 | 4 | 2 |
| | £10m | 1 | n/a | 2 | n/a | n/a |
| – 4% | Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
| | £1m | 3 | 5 | 1 | 4 | 2 |
| | £5m | 3 | 5 | 2 | 4 | 1 |
| | £10m | 2 | n/a | 1 | n/a | n/a |
| – 6% | Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
| | £1m | 5 | 3 | 2 | 4 | 1 |
| | £5m | 4 | 3 | 2 | 5 | 1 |
| | £10m | 2 | n/a | 1 | n/a | n/a |

Increasing the discount rate makes recoveries under Delay 5 greater by rank

Reinsurance Recoveries – Discounting – rank PV of recoveries

- real yield

| Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|--------|-------|-----|----------|----------|---------|
| £1m | 3 | 5 | 1 | 4 | 2 |
| £5m | 3 | 5 | 2 | 4 | 1 |
| £10m | 2 | n/a | 1 | n/a | n/a |

- Close to the 4% - unsurprising given current long term yields

Reinsurance Recoveries – Mortality – rank PV of recoveries

– Rated age

| Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|--------|-------|-----|----------|----------|---------|
| £1m | 3 | 5 | 1 | 4 | 2 |
| £5m | 3 | 5 | 2 | 4 | 1 |
| £10m | 2 | n/a | 1 | n/a | n/a |

– Additive

| Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|--------|-------|-----|----------|----------|---------|
| £1m | 3 | 5 | 2 | 4 | 1 |
| £5m | 3 | 5 | 2 | 4 | 1 |
| £10m | 1 | n/a | 2 | n/a | n/a |

– Multiplicative

| Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|--------|-------|-----|----------|----------|---------|
| £1m | 3 | 5 | 1 | 4 | 2 |
| £5m | 3 | 5 | 2 | 4 | 1 |
| £10m | 2 | n/a | 1 | n/a | n/a |

Choice of mortality curve affects the relative ranking

Reinsurance Recoveries – Inflation – rank PV of recoveries

| – 2% | Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|------|--------|-------|-----|----------|----------|---------|
| | £1m | 5 | 3 | 2 | 4 | 1 |
| | £5m | 5 | 3 | 2 | 4 | 1 |
| | £10m | 2 | n/a | 1 | n/a | 3 |
| – 4% | Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
| | £1m | 3 | 5 | 1 | 4 | 2 |
| | £5m | 3 | 5 | 2 | 4 | 1 |
| | £10m | 2 | n/a | 1 | n/a | n/a |
| – 6% | Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
| | £1m | 2 | 5 | 1 | 3 | 4 |
| | £5m | 3 | 5 | 1 | 4 | 2 |
| | £10m | 1 | n/a | n/a | n/a | n/a |

Increasing the inflation makes recoveries under Delay 20 greater by rank

Reinsurance Recoveries – Inflation – rank PV of recoveries

- Spiking of 20% for two years at 25 years post inception

| Excess | Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|--------|-------|-----|----------|----------|---------|
| £1m | 2 | 5 | 1 | 4 | 3 |
| £5m | 3 | 5 | 2 | 4 | 1 |
| £10m | 1 | n/a | 2 | n/a | n/a |

- Uncap provides greater PV of recoveries on the top layer

Reinsurance recoveries – Key caveats

- Does not consider capital implications
 - inflation/longevity/credit risk etc
 - These are significant for uncapitalised product and must be allowed for over the lifetime of the claimant
- Have not investigated second order effects
- Need to consider which are the appropriate assumptions for your company
- A spectrum of claims must be modelled, not just one claim
- Delayed capitalisation 20 will look less attractive if there is no impairment

Reinsurance recoveries – Key findings

- Overall table (taking n/a as 5)

| Uncap | IUA | Delay 20 | Fixed LE | Delay 5 |
|-------|-----|----------|----------|---------|
| 88 | 157 | 52 | 142 | 89 |

- Number of scenarios in each band

| Product | 1 | 2 | 3 | 4 | 5 | n/a |
|----------|----|----|----|----|----|-----|
| Uncap | 4 | 10 | 15 | 1 | 3 | 0 |
| IUA | 0 | 0 | 4 | 0 | 18 | 11 |
| Delay 20 | 17 | 15 | 0 | 0 | 0 | 1 |
| Fixed LE | 0 | 0 | 2 | 19 | 1 | 11 |
| Delay 5 | 12 | 7 | 1 | 2 | 0 | 11 |

- Hence in these scenarios Delay 20 provides the most consistently high PV of recoveries, due to payment as if unimpaired. followed by 5 year delay post settlement

Reinsurance recoveries – Key findings

- Total recoveries across all claim scenarios (£m)

| Product | Unl xs £1m | Unl xs £5m | Unl xs £10m |
|----------|-------------|------------|-------------|
| Uncap | 165,293,457 | 47,345,879 | 3,337,783 |
| IUA | 138,529,910 | 35,885,637 | 0 |
| Delay 20 | 181,789,878 | 69,769,520 | 3,736,453 |
| Fixed LE | 160,138,890 | 41,554,739 | 0 |
| Delay 5 | 175,362,998 | 71,107,127 | 207,231 |

- Hence in these scenarios Delay 20 provides the overall highest total PV of recoveries above £1m and £10, whereas the 5 year delay post settlement provides the greatest PV of recoveries xs £5m

note: potential conflict, I helped design delayed Cap 20 product

Reinsurance recoveries – Key findings

- Higher inflation shifts ranking of recoveries to delay 20 product
- Higher discounting shifts ranking of recoveries to delay 5 product
- Only uncapitalised and delayed cap 20 gave recoveries above £10m for these claim scenarios
- Fixed life expectancy and IUA products did not come in the top two overall in any group of claim scenarios
- Higher inflation leads to reduced recoveries, could be due to the model, as lump sum and PPO are independent of inflation
- Hence need to consider carefully the make up of your portfolio

— i.e. are these claims representative of your book?

Key messages

- 20 year delayed capitalisation product provides the greatest present value of recoveries under the claim scenarios considered
- Assumptions over inflation, discounting and mortality will affect the relative size of the loss burden.
- Choice of product from an insurer perspective will affect the capital they need to price into the insurance contracts