Institute of Actuaries of Australia

An examination of accident compensation claims during natural hazard events

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Presented to the Institute of Actuaries of Australia
Accident Compensation Seminar
20 - 22 November 2011
Brisbane

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Abstract

Over the last few years the occurrence of a number of major events has highlighted the impact that natural hazards can have on the community. We identify the major natural hazard events over the past 30 years and examine accident compensation scheme claims experience at such times to investigate the experience during such events. We consider the effects on claim frequency and whether certain parts of the community are impacted more than others to see if there are any lessons for Scheme management or the wider community.

Key words: Natural hazards; heatwaves, storms, CTP, workers compensation

Contents

Contents

1 Introduction

1.1 Origins of Paper

The idea for this paper first arose when one of the authors was researching the impact of heatwaves on the community and providing analysis to support the development of strategies to mitigate their impact on the population. This research identified that any adverse impacts was heavily influenced by our individual and our communities' responses to the conditions and by the resilience of our infrastructure. System failures within public transport systems in affected cities had, in some cases, exacerbated the underlying problems and made response efforts more challenging. At that time, the role of road transport was more difficult to assess; however we noted that it would be possible to at least consider motor vehicle related injuries through an examination of CTP experience, although time constraints prevented us from undertaking the analysis at that time.

Recently, the potential impact of other natural hazards has received widespread attention as we have seen an unprecedented level of catastrophic events in Australia and the Asia-Pacific region. Hailstorms in Melbourne and Perth were the start of a sequence of weather related events shortly followed by the Queensland Floods and Cyclone Yasi. Outside of Australia, the New Zealand and Japanese earthquakes dominated press coverage with these tragedies creating a monumental human, environmental and economic impact.

These events have generated some of the most expensive insurance losses in Australian history and rekindled our interest in the topic, giving rise to the question of whether there is anything that accident compensation schemes should be doing in response to the risk of hazards, either to manage their own risks or the risks faced by the communities they protect.

In this paper we seek make an initial attempt to examine this issue, by undertaking a top down study examining the claims experience of a number of Australian motor accident and workers compensation schemes during natural hazard events.

1.2 Acknowledgements

This paper would not have been possible without the assistance of the NSW Motor Accidents Authority, Transport Accident Commission, Motor Accident Insurance Commission, Q-Comp, WorkCover Authority of NSW, NSW Self Insurance Corporation, WorkSafe Victoria and the Bureau of Meteorology, all of whom provided data to us. The authors wish to express their appreciation for this.

We would also like to thank a number of colleagues who assisted with collating or analysing data for this paper – in particular Alex Gould and Ruth Goodwin.

2 A history of hazard events

The first step in our analysis was to identify the natural hazard events that would be considered in our analyses of experience.

Our concept was to consider as broad a variety of events as we could, with the investigations being limited by the availability of sufficient data rather than us narrowing the scope in the first instance. We did, however, choose to limit the analysis to natural events and hence did not consider the effects of man-made/environmental disasters or epidemics (e.g. industrial accidents, urban fires, criminal acts).

2.1 General hazards data

We identified two potential data sources for identifying hazard events:

- The Disasters Database maintained by the Commonwealth Government Attorney-General's Department[1]. This database contains records of all natural and non-natural disasters within Australia, and outside Australia where a number of Australians have been affected, dating from 1622 to the present day.
- The disaster statistics database maintained by the Insurance Council of Australia[2].

A review of the data sources suggested that the government database was more comprehensive; hence we used this for the identification of most hazard events.

We downloaded data for the natural hazard type events included in the database. These were: severe storm, bushfire, cyclone, earthquake, flood, hail, landslide, tornado and tsunami. A sample of this information is shown below.

Figure 1 Sample of hazards data

Event Type	Event Title	Zone	Region	Start Date	End Date	Dead	Injured	Insured Cost
Severe Storm	Adelaide - Robe, SA: Severe Storm (incl Tornado)	South Australia	Adelaide	8/08/2000	8/08/2000		3	Not Available
Severe Storm	Adelaide and Eyre Peninsula, SA: Land Gale (incl Storm Surge)	South Australia	Adelaide	26/06/2000	26/06/2000		1	Not Available
Severe Storm	Adelaide and Region, SA: Severe Storm (incl Dust Storm & Flash Floods)	South Australia	Adelaide	29/04/2000	29/04/2000			Not Available
Severe Storm	Adelaide and South-Eastern SA: Severe Storm (incl Hail & Flash Floods)	South Australia	Adelaide	26/05/2000	26/05/2000		8	Not Available
Severe Storm	Adelaide River, NT: Severe Storm (incl Lightning)		State Wide	29/01/2000	29/01/2000	1		Not Available
Severe Storm	Adelaide, SA: Severe Storm (incl Tornado and Flash Floods)	South Australia	Adelaide	7/09/2000	8/09/2000	1	3	Not Available
Severe Storm	Adelaide, SA: Severe Storm (incl. Tornado)	South Australia	Adelaide	24/07/2000	24/07/2000			Not Available
Severe Storm	Albany, WA: Severe Storm	Western Australia	Albany	2/08/2000	2/08/2000		2	Not Available
Severe Storm	Bynoe Harbour, NT: Waterspout (Tornado)		State Wide	3/12/2000	3/12/2000			Not Available
Severe Storm	Canberra, ACT: Severe Storm		State Wide	24/12/2000	24/12/2000		3	Not Available
Severe Storm	East Trentham, Vic: Tornado	Victoria	Melbourne	8/08/2000	8/08/2000		2	Not Available
Severe Storm	Esperance and Region, WA: Severe Storm (incl Downburst and Lightning)	Western Australia	Esperance	26/11/2000	26/11/2000			$600,000.00
Severe Storm	Gwalia and Kalgoorlie - Boulder, WA: Severe Storms (incl Flash Floods)	Western Australia	Kalgoorlie	10/01/2000	14/01/2000			Not Available
Severe Storm	Melbourne and SW Victoria: Severe Storm (incl Lightning & Flash Floods)	Victoria	Melbourne	21/12/2000	21/12/2000		5	Not Available

This database is quite extensive capturing information for 971 events, being those which caused three or more deaths or 20 injuries or illnesses; caused significant damage to property, infrastructure, agriculture or the environment; disrupted essential services, commerce or industry; or caused trauma or dislocation of the community at an estimated total cost of A$10 million or more.

In order to simplify the analysis we chose to limit our investigations to events in the three main Eastern states where the larger populations would make it easier to identify any trends in experience. Since many of the accident compensation schemes operating in the states we are considering commenced in the late 1980s we also limited the analysis to events from 1 January 1985 onwards. Events that did not meet these criteria were removed from our data.

[1] Attorney-General's Department Disasters Database. [Online] [Cited: 22 July 2011.] http://www.disasters.ema.gov.au/Default.aspx

[2] Insurance Council of Australia - Historical & current disaster statistics . [Online] [Cited: 24 06 2011.] http://www.insurancecouncil.com.au/Default.aspx?tabid=1572

This left 339 events for consideration, with a large number of storm, flood and bushfire events (over 50 for each) and much smaller numbers for the other types of hazards (fewer than 15 for each). No tsunami events remained.

In general we were seeking to be able to analyse a number of events for each type of hazard, preferably across multiple jurisdictions. This would provide a more robust body of evidence than would be the case if we had few events to examine. A review of the events for hazards other than storm, flood and bushfire showed that it would not be practical to examine all types of events. In particular we noted the following:

- Cyclone – there were a number of cyclones in Queensland, concentrated in the far North but with two reaching Brisbane. There were no cyclones further south so any analysis would be limited to Queensland.
- Earthquake – there were two earthquakes in the Sydney and surrounds region of NSW, notably the 1989 Newcastle earthquake.
- Hail – the events were limited to Queensland and New South Wales but included those impacting both Sydney and Brisbane.
- Landslide – all the events were highly localised and the data included a number of avalanches in the snowy mountains region.
- Tornado - there were only four tornados in the data and only one of these was in recent years and encompassed a major population centre.

On this basis, we discarded the landslide and tornado events as any analysis of state-wide accident compensation data would be likely to be inconclusive. We continued to pursue analysis of the other types of hazards, whilst noting the limitations discussed above.

To identify the final set of events for our analysis, we reviewed each of the types of hazard event and manually selected a set of events for analysis. The criteria we used were size of event and location (coverage of major population centres), including events from as many states as possible and a preference for more recent events. This produced a set of 38 hazard events for us to examine.

We also identified “black out” periods to avoid in our analysis, being those times when events occurred but were not selected in our final set of events to analyse.

2.2 Heatwaves data

For the identification of heatwaves we were provided with data from the Australian Government Bureau of Meteorology (BoM). This comprised daily data over the period 1 January 1981 to 31 December 2010 for Brisbane, Melbourne and Sydney with details of the daily maximum and minimum temperatures and the value of the Excessive Heat Factor (EHF), an index that can be used to identify heatwaves. Higher values of the EHF indicate a more extreme heat event.

The BoM also provided details of threshold values of this index for each location; severe heatwaves can be identified by assessing whether the EHF exceeds these thresholds. There were between 25 and 30 events in our dataset for each city which exceeded the threshold values. Given that there were a number of events in each location we eliminated the earlier events and selected the top five events in each city that occurred after 1 January 1990 for our analysis.

As for the other hazards we also identified “black out” periods to avoid in our analysis, being those times when heatwave events occurred but were not selected in our final set of events to analyse.

2.3 Summary of events

A summary of the number of natural hazard events selected for our analysis is provided below.

Whilst the number of events is quite limited for some types of hazard, we considered that it would be of interest to proceed with the analysis and then reconsider the data limitations when interpreting the results.

Figure 2 Summary of selected events by type and state

	VIC	NSW	QLD	All
Bushfire	3	3	1	7
Cyclone	0	0	3	3
Earthquake	0	1	0	1
Flood	4	4	3	11
Hail	0	2	3	5
Heatwave	5	5	5	15
Storm*	5	4	3	11
All	**17**	**19**	**18**	**53**

*Note that one storm event covered multiple states; hence the total number is not the sum of the number of events by state.

3 Analysis approach

3.1 Matched pairs

Investigating the effect of hazard events on motor vehicle bodily injury and workers compensation claims is challenging as it is usually difficult to isolate a single cause for the claim – more likely there are a number of contributing factors.

As such, we used a matched pairs approach for our analysis. This approach attempts to control for many of the factors that influence claims experience by comparing the experience during hazard events with that during control periods. The technique first identifies the observations in the data during the period of hazard events and then pairs each event with a suitable control period where no hazard was observed. For example, experience during a stormy Monday in February could be paired with that during a dry Monday in February.

The accident experiences for the periods with hazard conditions are then compared to that during the control periods. This approach attempts to negate the effects of other variables that will affect the overall accident rate. The estimate of the effect of the adverse factor (in this case, the hazard) is based on the combined data from many event-control pairs.

The details of how we formed the control periods for each event are described below.

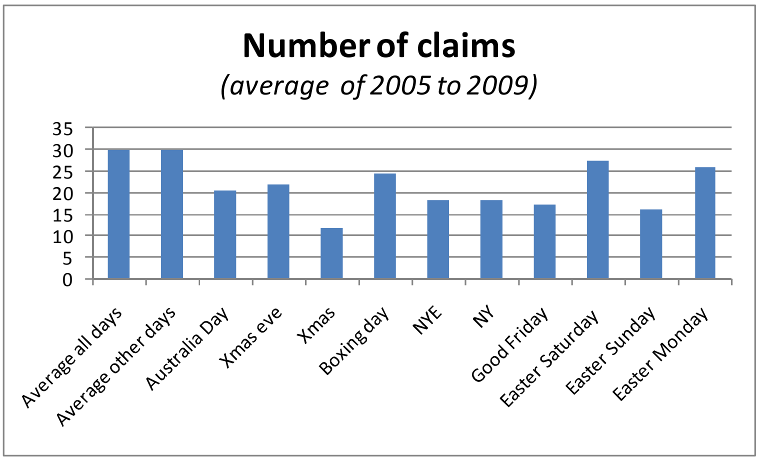
3.2 Control periods for short events

There was considerable variation in the recorded duration for some of the hazard events that we were considering. We managed this by first developing an analysis approach for shorter events (which made up the majority) and then adjusting it for the small number of longer events.

In forming the control periods we noted that:

- Different events impacted different states.
- There is considerable variation in claims experience by day of the week and time of day for both motor vehicle claims and workers compensation claims.
- We had identified a number of "black out" periods during our identification of hazard events that we did not want to include as control periods.
- It would be preferable to select control periods that were as close as possible to the event periods to minimise the effect of environmental changes, such as those in road systems, vehicle safety and drivers attitudes and seasonal effects e.g. differing hours of daylight at different times of year.
- It would also be preferable to select control periods that have the same legislative environment as in place during the event. If the period between the event and control periods bridges any major legislative changes it would invalidate the analysis. We were mindful of this and reviewed the events, noting those which fell close to any such changes.
- The experience during holiday periods is different to that during the rest of the year, as people work less and have different patterns of road use. This is illustrated by an examination of daily CTP claim numbers in NSW shown below.

Figure 3 Illustration of CTP claim numbers during holidays

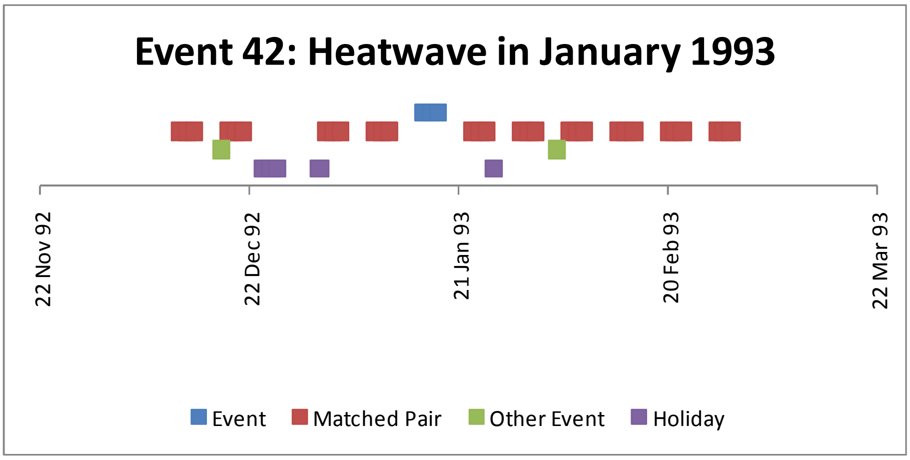


Having considered these observations, we developed an algorithm to select the nearest available periods either side of the event period which were of the same length and started on the same day of the week (and so had the same mix of weekdays), but which avoided holidays and black out periods.

Using this algorithm we selected the nearest ten control periods for each event within each state, where the event was relevant to that state. We used multiple control periods to improve the robustness of our control observations by reducing the effects of the natural random variations in the claims experience.

An example of how this algorithm operates for a single event is shown pictorially in the diagram below.

Figure 4 Illustration of selection of control periods for analysis (event duration <=14 days)



This approach was used for all events which had durations of two weeks or less. This comprised 48 of the 53 events we were analysing.

3.3 Control periods for longer events

There were five events that had recorded durations in excess of two weeks. Four of these were bushfires and the other was a storm event.

It was more challenging to develop appropriate control periods for these longer events as the greater duration meant that it there was an increased likelihood of potential control periods being discarded as overlapping with holidays or black out periods and it is more likely that applying the algorithm we developed would result in the selection of days from different seasons.

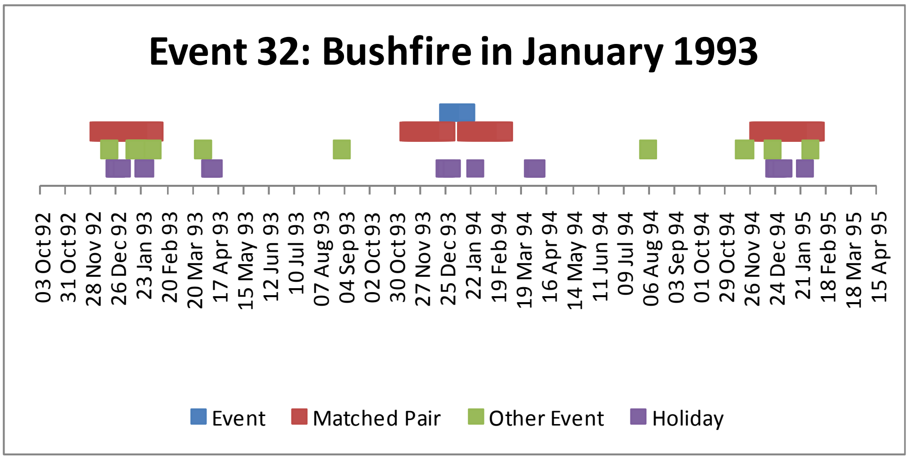
We also had some concerns as to whether the recorded duration for these events was appropriate for our purposes. For example, the duration for storms may have been recorded from the time the weather system was first identified until it dissipated – this could be significantly longer than the time from which it represented a material hazard to populated regions. We did not adjust our data for this concern; however we considered it in interpreting the results.

For these longer events we used information from surrounding years as well as the year of the event to develop the matched pairs. We also omitted the criteria of avoiding holidays and other events since the effect of holidays would be less when averaged across a longer period and many of the events themselves also covered holiday periods.

By selecting data from a number of years it meant the analysis was less susceptible to seasonal differences but with a trade off of being more likely to be affected by general trends in experience or legislative changes. We attempted to mitigate any impact of general trends in experience by selecting control periods both before and after the event.

An example of how this amended algorithm worked for a single event is shown in the diagram below.

Figure 5 Illustration of selection of control periods for analysis (event duration >14 days)



Note: Whilst the chart suggests the event period overlaps the matched pair control periods that is not actually the case – it is simply a limitation of the functionality of the chart software we used to generate the illustration.

3.4 Analysis performed

Our analysis examined the effects of the hazards on claim frequency and on the mix of claims by other characteristics recorded in the claim file.

In order to perform our analysis we converted our hazard event and control events data into a daily dataset and then used this in combination with the individual claim data that we had received for each jurisdiction. At a high level the approach we took was as follows:

- For each state, identify claims occurring during each of the hazard events and during the control periods for that event.
- Analyse the claim frequency by considering the average daily numbers of claims and calculating the ratios of claims during the events to that during the controls.
- Analyse the profile of claims by undertaking a series of one way analyses of the claims mix:
  - Identifying variables in the claims data that captured claim and claimant characteristics which may be of interest and would be likely to be sufficiently well populated. (We focussed on variables which were collected in more than one state and those which took a manageable number of different values).
  - Considering the prevalence of each characteristic through one-way analyses of the claims by measuring the proportion of claims with that characteristic.
  - Calculating the ratios of that prevalence during the events to that during the control periods.

- Analyse the extent of any differentials in the average cost of claims, again through developing ratios of the costs of claims during hazard events versus those during control periods.

Whilst we followed this analysis process for each event we recognised that some of the data is quite sparse and have been hesitant to develop our conclusions directly from this. We generally limited our conclusions to those formed from analysis results for the types of event / location combination where there have been at least three examples in the set of events analysed.

4 Examination of motor accidents experience

4.1 States examined / data sources

Our analysis of motor accidents experience is based on the following data:

- Victorian (VIC) claims data provided by the Transport Accident Commission. This included claims over the period 1 April 1987 to 31 October 2010.
- New South Wales (NSW) claims data provided by the Motor Accidents Authority. This included claims over the period from 1 July 1989 to 30 June 2011.
- Queensland (QLD) data provided by the Motor Accident Insurance Commission. This covered claims over the period from 1 September 1994 to 30 June 2011.

We note that the Victorian scheme provides cover on a no fault basis whereas the CTP schemes in the other two states are fault based schemes.

4.2 Claim profile characteristics considered

We considered the following characteristics in our analysis of motor accident claims

- Claim frequency
- Accident role (e.g. driver, passenger, pedestrian)
- Age and gender
- Injury severity and Injury type: prevalence of severe brain and spinal injuries and whiplash injuries, as well as proportion of claimants attending hospital
- Claim types – prevalence of nominal defendant and shared claims
- Proportion of claimants legally represented
- Reporting delay
- Cost

We also examined the experience for a few other variables including use of seatbelts and whether a level of intoxication was recorded; however there was insufficient data for us to identify any meaningful results for these variables.

It is important to note that when analysing the mix of claims by characteristic we examined the change in mix of claims rather than the absolute number of claims. Thus, if the overall claim frequency during an event doubled but the number of claims for cyclists increased by half, this would be recorded as a lower proportion of claims from cyclists. We took this approach in order to identify groups of claimants which were being disproportionately impacted by the events.

4.3 Analysis results

The findings from our analysis of CTP claims experience are summarised below. Further details of the results for each variable considered are provided in Appendix B.

Hazard	No of events	Findings
Storm	12	• Generally higher claim frequency • Evidence of a higher proportion of low severity claims and a reduced proportion of high severity claims, indicating that much of the increase in claim numbers is for low severity claims. • Weak evidence of a lower average claim size (possibly related to the severity mix) • Reduced proportion of claims for cyclists & motorcyclists and older people. • An increased proportion of passenger claims. • Weak evidence of an increased proportion of shared claims
Hail	5	• Generally higher claim frequency • No clear evidence of any change in mix of claims by injury severity or type • Reduced proportion of claims for cyclists and increased proportion of claims for pedestrians
Cyclone	2	• A slightly higher claim frequency • Reduced proportion of high severity claims • No clear evidence for the other characteristics examined
Flood	11	• A higher claim frequency • Evidence of a lower proportion of mid and high severity claims, including a lower proportion of fatalities • Reduced proportion of claims for cyclists & motorcyclists • A shorter average reporting delay • Little clear evidence of any change in mix of claims by the other characteristics examined (including: age, gender, shared, legal representation) • Lower average cost
Bushfire	7 (3 long duration)	• No consistent observed change in claim frequency • Increased proportion of fatalities • Increased proportion of claims from passengers, weak evidence of a reduced proportion from cyclists • Increased proportion of claims for children; a mixed picture for people of other ages (reduced proportion for those aged 40-50 but increased for age 50-60)
Heatwave	14	• No clear change in claim frequency • Weak evidence of a higher proportion of high severity claims, including a higher proportion of fatalities • Mixed evidence in relation to any changes in the mix of claims – the analysis suggests weak evidence of an increased proportion of claims for young people
Earthquake	1	• The analysis showed a reduced claim frequency • A greater proportion of high severity claims.

5 Examination of workers compensation experience

5.1 States examined / data sources

We used the following data for our workers compensation analyses:

- Victorian (VIC) claims data provided by WorkSafe Victoria
- New South Wales (NSW) claims data provided by the NSW WorkCover Authority and the Treasury Managed Fund (TMF)
- Queensland (QLD) data provided by Q-Comp

The Victorian data covers both the public and private sector but excludes self-insurers. The Queensland data covers the full system.

For NSW our analysis is based on data from both the NSW WorkCover Scheme (which covers private sector organisations but excludes self and specialised insurers) and TMF data (which covers the most significant government self insurance scheme managed by the NSW Self-insurance Corporation). Some parts of the analyses were undertaken using only the NSW WorkCover data.

5.2 Claim profile characteristics considered

We considered the following characteristics in our analysis:

- Claim frequency
- Age and gender
- Employment type (e.g. part time/ full time)
- Industry (by ANZSIC division of employer)
- Injury code: mix of disability types (fatal, permanent total, permanent partial, temporary)
- Injury type: bodily location of injury (e.g. head, upper limbs etc.)
- Accident details:
    - Location: details on where the accident occurred (e.g. in the workplace, in public thoroughfares, whilst using transport etc.)
    - Duty status: e.g.: At work, Commuting, Recess period
    - Type of accident (e.g. Falls, slips & trips, Being hit by moving object, Body stressing)
    - Agency of accident (e.g. Chemicals, Machinery & Fixed Plant)
- Cost

Not all the above characteristics were examined for each state due to either insufficient or unavailable data.

We also examined the experience for a few other variables including work days lost, however there was insufficient data for us to identify any meaningful results for these variables.

5.3 Analysis results

The findings from our analysis of workers compensation claims experience are summarised below. Further details of the results for each variable considered are provided in Appendix C.

Hazard	No of events	Findings
Storm	12	• Generally higher claim frequency • Weak evidence of a small change in mix of claimants, with a slightly higher proportion of claims being from females • Some increase in proportion of claims from Public Administration & Safety workers • Little evidence of any trends in other characteristics or in claims cost
Hail	5	• Little overall change in proportions of claims by industry; weak evidence of a reduced proportion from Education & Training workers
Cyclone	2	• A slightly higher claim frequency • A higher average cost despite having more zero claims • No clear evidence of any change in mix of claims for the other characteristics examined
Flood	11	• Generally lower claim frequency • Some evidence of a greater proportion of claims being from older workers and female workers • Little clear evidence of any change in mix of claims by industry, weak evidence of an increased proportion in Mining and Retail Trade
Bushfire	7 (3 long duration)	• No consistent observed change in claim frequency • Greater proportion of claims for females • Some evidence of an increased proportion of claims for the segments of the public sector workforce who are likely to be involved in emergency response (e.g. Ambulance Services, Police and Fire Brigades) • Weak evidence (one state only) of an increased proportion of claims on construction sites and an increased proportion being recorded as caused by heat • A slightly higher average cost
Heatwave	14	• Slight reduction in claim frequency • Slightly greater proportion of claims for males and some older workers • Weak evidence of an increased proportion of claims in Manufacturing and Accommodation and Food Services • Weak evidence (one state only) of an increased proportion of claims on construction sites and an increased proportion being recorded as caused by heat • A slightly lower average claim size
Earthquake	1	• A reduced claim frequency • A greater proportion of claimants being female and part-time (these two variables have a positive correlation).

6 Summary of overall findings

We found that interpreting the findings of this study was inherently challenging. Even for the hazards where we had a significant number of events to consider and a substantial number of claims there were many factors where the results were not consistent. Significant changes in claims experience may have been observed across all events in one state, but not be replicated in another or the experience may be very mixed between events. This would suggest other factors including random variation may be at play.

Notwithstanding these difficulties, the main themes emerging from our observations and possible interpretations for each type of hazard are discussed below.

6.1 Storm, Hail and Cyclone

Our analysis of these events covered all three states, although the only cyclones were in Queensland and hail events were only in Queensland and New South Wales.

During these adverse weather events we saw a clear increase in motor accident claims; the result for workers compensation claims was much less clear although there were indications of a small increase in claims.

When examining mix of claims there was some evidence of a small shift in mix, for example:

- For motor: increased proportion of low severity motor vehicle claims, reduced proportion of claims for cyclists and motorcyclists, weak evidence of an increased proportion of claims for pedestrians and younger people
- For workers compensation: weak evidence of a slightly greater proportion of claims from female workers, some minor shifts in claim mix by industry

Whilst the evidence base was weak the results for a number of variables suggested that much of the increase in motor accident claim frequency may be caused by multi-vehicle collisions resulting relatively low severity injuries, perhaps consistent with rear end collisions and similar. This would align with the findings of a previous research paper[3] which investigated the relationship between rainfall and CTP claims in NSW and found increases in claim frequency of up to 10% on days with heavy rainfall, with the biggest increases in the lower severity claims.

Our observations capture the combined effect of changes in exposure (road use, attendance at work) and risk of incidents giving rise to claims. The observations included a general increase in claim numbers; this would be in spite of any tendency for people to stay at home in adverse weather.

Beyond this, we consider that the motor accident experience is probably reflective of patterns of road usage during these events: people may avoid journeys unless they need to and, in particular, may be less likely to cycle or use a motorcycle if the weather is bad.

For workers compensation, whilst there are slightly more claims overall, there is little evidence of any particular groups of workers having an elevated risk of injury.

6.2 Floods

Flooding is a more localised hazard than adverse weather and although we selected the events which were likely to impact the biggest proportion of the population we considered that we would find it challenging to identify any clear evidence of floods influencing the claims experience.

Whilst we observed a slight increase in motor accident claim frequency arising from more low severity claims, we are hesitant to attribute this directly to the flood event since flooding is intrinsically linked to periods of substantial rainfall and the experience may be a result of the adverse weather rather than the flood itself.

[3] *Determinants of Claim Frequency In CTP Schemes*, by Raewin Davies, Rosi Winn and Jack Jiang presented to the 2004 Institute of Actuaries Accident Compensation Seminar

For workers compensation the analysis claim frequency showed a slight reduction in claims; there was little clear evidence of any material change in mix of claims. This result may simply capture the effect of people staying at home if their home, workplace or transport routes are flooded or modifying their activities if the weather is generally poor.

Further work would be required to investigate the impacts of floods more fully, including perhaps analyses which examined the experience at a more granular level of location (e.g. postcode level).

6.3 Bushfires

Bushfires are highly localised events; as such we were unsure whether any effects would be observed. The analysis covered seven events across all states, with the events typically covering a run of days, sometimes extending into weeks. These factors limited our ability to develop appropriate control pairs for the analysis.

For bushfires we observed:

- Little change in overall claim numbers for either CTP or workers compensation but a slight increase in motor accident fatalities.
- Evidence of increased claims from emergency services and related workers i.e. those whose jobs may entail responding to the hazard. Evidence of any other change in claim mix was weak.

We undertook a brief examination of the experience by postcode; there were significant spikes of claims in several post codes for bushfire workers compensation injuries, confirming the localised nature of this hazard. Further analysis at this more granular level of experience would be needed to identify any other patterns of experience.

6.4 Heatwaves

Heatwaves often occur at similar times of year as bushfires, however they generally cover a broader area and, as we had a significant number of heatwave events to examine, we thought it more likely that our analysis would generate results of interest. Indeed, heatwaves can have an amplified effect as heat builds up more in urban areas, precisely where there is a higher population density.

However, our motor accident analysis unearthed little evidence of any significant changes in claim frequency or mix. Although there was weak evidence of increased numbers of high severity claims, including fatalities and an increased proportion of claims from younger people.

The workers compensation analysis provided a few more insights, showing that whilst there was a reduction in overall claim frequency, there were slightly increased risks for older workers and a bias towards those working in certain industries (specifically manufacturing and food & accommodation services).

Our previous work on heatwaves included a review of research on the health and psychological impacts of heat. This identified that there are some clear heat related illnesses, including: heat stroke, heat exhaustion and heat syncope (dizziness or loss of consciousness). There is also evidence to suggest a link between heat and aggressiveness including increased stress[4] and road rage[5]. Older people and those with certain pre-existing medical conditions (e.g. cardiovascular and respiratory conditions) are particularly susceptible[6]. The degree of

[4] Simester and Cooper, "Thermal Stress in the USA: effects on violence and employee behaviour" *Stress and Health 21: 3-15,* (2005)

[5] Kenrick and MacFarlane "Ambient temperature and horn-honking: A field study of the heat/aggression relationship" *Environment and Behaviour*, 18, 179-191, 1984

[6] Basu, R. (2009). High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008, *Environmental Health*, 8,40; Ebi, K. & Meehl, GA. (2007). Heatwaves & global climate change – the heat is on: climate change & heatwaves in the Midwest. Arlington: Pew Center on Global Climate Change; Flynn, A., McGreevy, C. & Mulkerrin, E.C. (2005). Why do older patients die in a heatwave? *QJM*, 98(3), 227-229; Menne, B., Apfel, F., Kovats, S. & Racioppi, F. (eds). World Health Organisation – Europe (WHO) (2008). Protecting Health in Europe from climate change, Copenhagen: WHO; Reid, C.E., O'Neill, M.S., Gronlund, C.J., Brines, S.J., Brown, D.G., Diez-Roux, A.V. & Schwartz, J. (2009). Mapping community determinants of heat vulnerability, *Environmental Health Perspectives*, 117(11), 1730-36; World Health Organisation – Europe (WHO). (2009). Improving public health responses to extreme weather/heat-waves – EuroHEAT: Technical summary. Copenhagen: WHO.

acclimatisation is also important; those living in warmer climates may have better heat tolerance and may have modified their behaviours to deal better with heat[7].

We had formed a working hypothesis from this information that there may be more motor vehicle accidents of types caused by a loss of concentration as road users have their judgement impaired by the heat. It would be possible to interpret the increased prevalence of claims from pedestrians and younger people as lending some support to the hypothesis although this could equally be caused by a range of other factors. (Whilst young people are generally less susceptible to heat than older adults, they may also have been less likely to have a car with air conditioning!) The lack of any clear increase in claim numbers shows that even if this does occur, its effect on the overall scheme experience is not large.

There was only weak evidence from the workers compensation claims analysis of there being more claims for the at risk group of older workers. This might suggest that even when such individuals suffer from adverse health effects in the heat this is not prevalent enough to contribute to significantly more workplace accidents overall.

It would be possible to interpret the workers compensation results as reflecting the extent to which people are able to easily modify their behaviours on a hot day to deal with the heat – most people may try and stay in a cool environment and reduce their activity level; those working in manufacturing and in the food industry may not be able to do this and additionally may be working near hot machinery or stoves.

The shift in claims by industry does perhaps indicate a need for care in some industries where workers may undertake more physical activity or be more exposed to hot conditions.

6.5 Earthquakes

We had very limited experience for earthquake, with our results being derived solely from the Newcastle earthquake in 1989.

The data for this is quite old and may be of limited relevance to the current environment. Care should be taken in drawing conclusions because of the small sample size of one event, less than for the other hazards considered. Furthermore the earthquake occurred on 28 December 1989 at 10.27am, i.e. during the Christmas period and fairly early in the day. There was an aftershock the next day.

The analyses showed:

- a reduced claim frequency for motor accident injuries but greater proportion of high severity claims, and
- a reduced claim frequency for workers compensation, with more of the reduction in claims for males and full time workers.

The reductions in claim frequency may relate to people being at home over the holiday period and staying at home during the day after the event occurred (as consistent with general advice on how to respond during earthquakes).

We have noted these findings for interest only since the available experience provides an insufficient body of evidence from which to draw any reliable conclusions.

We would suggest that further research is required to explore the impacts of this hazard. As Australia is not prone to seismic activity one would need to explore overseas experience to develop any link between earthquakes and motor accidents and subsequent injuries. Given the greater prevalence of earthquakes in New Zealand it would be interesting to examine the experience of the Accident Compensation Corporation in this regard.

[7] Basu, R. (2009). High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008, *Environmental Health*, 8, 40; Knochel, J.P. and G. Reed. (1994). Disorders of heat regulation. In: M.H. Maxwell, C.R. Kleeman, RG Narins, eds. *Clinical disorders of fluid and electrolyte metabolism*, 5th ed. New York, McGraw-Hill Inc Knowlton, K., Rotkin-Ellman, M., King, G., Margolis, H.G., Smith, D., Solomon, G., Trent, R. & English, P. (2009). The 2006 California heat wave: impacts on hospitalisations and emergency department visits. *Environmental Health Perspectives*, 117(1), 61, 61-67; Smoyer, K. 1998. A comparative analysis of heat waves and associated mortality in St. Louis, Missouri – 1980 and 1995; World Health Organisation (WHO) (2004). Heat-waves: risks and responses. Copenhagen: WHO.

6.6 Conclusions

We undertook this macro level study examining the experience of accident compensation schemes with the aim of identifying any messages for scheme managers. In particular, items that may impact on the overall scheme financial and risk management and areas that could be targeted for prevention activities to improve community safety during hazard events.

- It is clear that **adverse weather** causes increased numbers of claims, despite indications of a reduced exposure from people avoiding unnecessary journeys. However within this overall experience there was only weak evidence of which groups were more at risk. The slight increase in road accidents for young people should reinforce the safety messages already focussed on this group. Of more interest is the increase in claims for pedestrians; fewer safety messages are currently being aimed at them.
- Our analysis of **flood** events found little to distinguish the experience from that seen during other types of adverse weather events
- For **bushfires**, our analysis demonstrated the highly localised nature of this risk. It also highlighted the direct risk of the hazard event – both for road users and for those responding to the event as part of their jobs. Beyond this, our analyses were unable to clearly identify any major segments of the community that stand out for targeting of prevention activities.
- For **heatwaves** it was pleasing to observe little evidence in increased claims for the more at risk groups, indicating perhaps that people are able to modify their behaviours to mitigate the heat and prevent more accidents. There are, however, some messages that people working in industries with more physical activity or hot conditions do need to be aware of the risks and take care on hot days. Schemes may be able to assist workers through initiatives to clearly communicate the risks, the need to take care and how to identify the early indications of people suffering the adverse effects of heat.

Looking across all the types of hazards we investigated, the claims impacts at an overall Scheme level were relatively benign. Whilst we saw increased claims during some events we saw reductions during others, possibly indicating that much of the community is already mitigating the risks to the extent they easily can.

From a scheme perspective even where the claim frequency increased the magnitude of the increase was not large. This has implications for reinsurance purchasing decisions, one interpretation could be that, as the impact of hazards on scheme finances is not generally large, much of the risk could perhaps be retained rather than reinsured.

We note that our study does however have some limitations, particularly where hazards are more localised in nature or do not occur often in the jurisdictions that we examined. Such events are not well reflected in the full data of any of the schemes we examined. Further analysis would be required to gain insights into such events.

Appendix A. Summary of events and control days by state

Events in New South Wales

Event ID	Event Type	Start date	End Date	Event duration	No of control pairs	Earliest pair start date	Latest pair end date	Long duration event?	Other comments
7	Storm	21-Jan-91	21-Jan-91	1	10	17-Dec-90	4-Mar-91	No	
8	Storm	12-Feb-92	13-Feb-92	2	10	8-Jan-92	26-Mar-92	No	
9	Storm	20-Nov-94	20-Nov-94	1	10	9-Oct-94	18-Dec-94	No	A Sunday
11	Storm	1-Feb-05	2-Feb-05	2	10	28-Dec-04	16-Mar-05	No	
12	Flood	7-Jun-07	24-Jun-07	18	10	17-May-06	14-Jul-08	Yes	Overlaps time of when LTCS was introduced
13	Hail	3-Dec-01	3-Dec-01	1	10	22-Oct-01	14-Jan-02	No	
14	Flood	24-Oct-99	24-Oct-99	1	10	19-Sep-99	28-Nov-99	No	A Sunday, overlaps major legislative change in CTP
22	Hail	14-Apr-99	14-Apr-99	1	10	10-Mar-99	19-May-99	No	
28	Flood	7-Jun-91	16-Jun-91	10	10	15-Mar-91	8-Sep-91	No	
29	Flood	18-Aug-98	18-Aug-98	1	10	14-Jul-98	22-Sep-98	No	
31	Earthquake	28-Dec-89	29-Dec-89	2	10	23-Nov-89	9-Feb-90	No	Old - only have partial data
32	Bushfire	27-Dec-93	16-Jan-94	21	10	6-Dec-92	6-Feb-95	Yes	
35	Bushfire	21-Dec-01	15-Jan-02	26	10	23-Nov-00	12-Feb-03	Yes	
36	Bushfire	9-Oct-02	9-Oct-02	1	10	4-Sep-02	13-Nov-02	No	
39	Heatwave	22-Jan-09	24-Jan-09	3	10	11-Dec-08	14-Mar-09	No	Includes a Saturday
40	Heatwave	7-Jan-94	8-Jan-94	2	10	26-Nov-93	19-Feb-94	No	Includes a Saturday
41	Heatwave	24-Jan-01	26-Jan-01	3	10	6-Dec-00	2-Mar-01	No	
42	Heatwave	16-Jan-93	18-Jan-93	3	10	12-Dec-92	1-Mar-93	No	Includes a Saturday & Sunday
43	Heatwave	21-Nov-09	22-Nov-09	2	10	17-Oct-09	3-Jan-10	No	Includes a Saturday & Sunday

Events in Queensland

Event ID	Event Type	Start date	End Date	Event duration	No of control pairs	Earliest pair start date	Latest pair end date	Long duration event?	Other comments
5	Storm	16-Nov-08	22-Nov-08	7	10	5-Oct-08	20-Dec-08	No	
6	Storm	7-Oct-07	12-Oct-07	6	10	2-Sep-07	16-Nov-07	No	Includes 1 Sunday
10	Storm	13-Oct-98	13-Oct-98	1	10	8-Sep-98	17-Nov-98	No	
16	Cyclone	20-Mar-06	20-Mar-06	1	10	13-Feb-06	1-May-06	No	
17	Cyclone	3-Feb-90	7-Feb-90	5	10	6-Jan-90	21-Mar-90	No	Includes 1 weekend, incomplete data
18	Cyclone	2-Feb-11	3-Feb-11	2	10	29-Dec-10	17-Mar-11	No	
19	Hail	16-Dec-98	16-Dec-98	1	10	11-Nov-98	20-Jan-99	No	
20	Hail	3-Nov-95	6-Nov-95	4	10	29-Sep-95	11-Dec-95	No	Includes 1 weekend
21	Hail	12-Oct-05	12-Oct-05	1	10	7-Sep-05	16-Nov-05	No	
23	Flood	9-Mar-01	11-Mar-01	3	10	2-Feb-01	22-Apr-01	No	Includes 1 weekend
24	Flood	27-Dec-07	7-Jan-08	12	10	20-Sep-07	28-Apr-08	No	Includes 2 weekends
25	Flood	1-May-96	9-May-96	9	10	21-Feb-96	1-Aug-96	No	Includes 1 weekend
34	Bushfire	27-Sep-94	7-Nov-94	42	10	16-Aug-93	19-Dec-95	Yes	
44	Heatwave	5-Jan-94	10-Jan-94	6	10	24-Nov-93	28-Feb-94	No	Includes 1 weekend
45	Heatwave	20-Feb-04	23-Feb-04	4	10	2-Jan-04	19-Apr-04	No	Includes 1 weekend
46	Heatwave	20-Jan-00	23-Jan-00	4	10	9-Dec-99	5-Mar-00	No	Includes 1 weekend
47	Heatwave	7-Jan-04	9-Jan-04	3	10	19-Nov-03	5-Mar-04	No	
48	Heatwave	31-Jan-96	2-Feb-96	3	10	27-Dec-95	15-Mar-96	No	

Events in Victoria

Event ID	Event Type	Start date	End Date	Event duration	No of control pairs	Earliest pair start date	Latest pair end date	Long duration event?	Other comments
1	Flood	21-Dec-00	21-Dec-00	1	10	23-Nov-00	1-Feb-01	No	
2	Storm	2-Dec-03	3-Dec-03	2	10	28-Oct-03	14-Jan-04	No	
3	Storm	4-Feb-11	6-Feb-11	3	10	7-Jan-11	27-Mar-11	No	Includes 1 weekend
4	Storm	6-Mar-10	7-Mar-10	2	10	30-Jan-10	18-Apr-10	No	1 weekend
11	Storm	1-Feb-05	2-Feb-05	2	10	28-Dec-04	16-Mar-05	No	
15	Storm	2-Apr-08	2-Apr-08	1	10	27-Feb-08	7-May-08	No	
26	Flood	6-Nov-95	9-Nov-95	4	10	2-Oct-95	21-Dec-95	No	
27	Flood	16-Dec-91	18-Dec-91	3	10	4-Nov-91	29-Jan-92	No	
30	Flood	12-Jan-11	18-Jan-11	7	10	24-Nov-10	8-Mar-11	No	
33	Bushfire	7-Feb-09	8-Feb-09	2	10	3-Jan-09	22-Mar-09	No	1 weekend
37	Bushfire	10-Feb-00	10-Feb-00	1	10	6-Jan-00	23-Mar-00	No	
38	Bushfire	31-Dec-05	31-Jan-06	32	10	26-Nov-04	7-Mar-07	Yes	
49	Heatwave	29-Jan-09	1-Feb-09	4	10	18-Dec-08	22-Mar-09	No	Includes 1 weekend
50	Heatwave	7-Feb-97	8-Feb-97	2	10	3-Jan-97	15-Mar-97	No	Includes a Saturday
51	Heatwave	21-Jan-06	22-Jan-06	2	10	10-Dec-05	5-Mar-06	No	1 weekend
52	Heatwave	3-Feb-00	4-Feb-00	2	10	30-Dec-99	17-Mar-00	No	
53	Heatwave	6-Dec-94	7-Dec-94	2	10	8-Nov-94	18-Jan-95	No	

Appendix B. Summary of motor vehicle accident analysis results

A summary of our analysis results for each event type is provided below. Whilst we examined the experience for a number of further variables (use of seatbelts, intoxication, spinal injuries) there was insufficient data to identify any meaningful results for these.

Storm (results across 12 events covering all states)

Characteristic Analysed	*NSW (4 events)*	*QLD (3 events)*	*VIC (5 events)*
Frequency	Inconclusive	Higher	Higher
Age (proportion of claimants in age band)	Fewer 70+	More 25-30, Fewer 40-50, 60-70	Fewer 70+
Gender	Inconclusive	Fewer males	Inconclusive
Injury Severity (MAIS category)	More low severity (1) Fewer high severity (4, 5)	Fewer high severity (5)	More low severity (1) Fewer mid severity (2, 3, 4)
Whiplash	Inconclusive	Inconclusive	Higher proportion
Claimant Role	More pedestrian Fewer cyclist	More passengers Fewer cyclists motorcyclists and pedestrians	More drivers, passengers, tram/train Fewer motorcyclists
Brain Injury (< 2% of claims)	Insufficient data	Sparse data, weak evidence of more brain injuries	Sparse data, weak evidence of fewer brain injuries
Legal Representation	Inconclusive	Inconclusive	Inconclusive
Shared	Inconclusive	Higher proportion	n/a
Hospital	Insufficient data	Insufficient data	Less hospitalisation
Reporting Delay	Longer, mixed	Inconclusive	Inconclusive
Nominal defendant	Inconclusive	Insufficient data	n/a
Cost	Inconclusive	Inconclusive	Lower average cost

Hail (results across 5 events covering NSW and QLD only)

Characteristic Analysed	*NSW (2 events)*	*QLD (3 events)*	*VIC (No events)*
Frequency	Higher	Inconclusive	
Age	More U20s and 30-40 Fewer 25-30 and 60+	More U15	
Gender	Fewer males	Inconclusive	
Injury Severity (MAIS category)	More mid & high severity (3,4,5)	Fewer high severity (4, 5) Fewer fatalities (6)	
Whiplash	Lower proportion	Higher proportion	
Claimant Role	More pedestrians and motorcyclists Fewer cyclists	More pedestrians, drivers Fewer motorcyclists	
Brain Injury	Sparse data, weak evidence of more brain injuries	Insufficient data	
Legal Representation	Lower proportion	Inconclusive	
Shared	Inconclusive	Inconclusive	
Hospital	Insufficient data	Insufficient data	
Reporting Delay	Longer delay	Inconclusive	
Nominal defendant	Inconclusive	Insufficient data	
Cost	Inconclusive	Inconclusive	

Cyclone (results across 2 events in Queensland only)

Characteristic Analysed	***NSW (No events)***	***QLD (2 events)***	***VIC (No events)***
Frequency		Slightly higher	
Age		Fewer U25s More 25-30	
Gender		Fewer males	
Injury Severity (MAIS category)		Fewer high severity (4, 5) Fewer fatalities (6)	
Whiplash		Inconclusive	
Claimant Role		More passengers, more motorcyclists Fewer pedestrians	
Brain Injury		Insufficient data	
Legal Representation		Higher proportion	
Shared		Inconclusive	
Hospital		Insufficient data	
Reporting Delay		Shorter delay	
Nominal defendant		Insufficient data	
Cost		Inconclusive	

Flood (results across 11 events covering all states)

Characteristic Analysed	***NSW (4 events)***	***QLD (3 events)***	***VIC (4 events)***
Frequency	Higher	Inconclusive	Higher
Age	Slightly fewer 20-25, 70+	Fewer 40-60 More U15, 20-25	Fewer 15-20, 70+
Gender	Inconclusive	Inconclusive	Inconclusive, possibly fewer male
Injury Severity (MAIS category)	Fewer mid & high severity (3, 4, 5) Fewer fatalities (6)	Fewer high severity (4, 5) Fewer fatalities (6)	Fewer mid severity (2, 3)
Whiplash	Inconclusive	Inconclusive	Higher proportion
Claimant Role	More driver Fewer pedestrian, and motorcyclist	Fewer motorcyclist	More passenger, pedestrian Fewer cyclist, motorcyclist
Brain Injury	Insufficient data	Sparse data but possibly more	Insufficient data
Legal Representation	Inconclusive	Inconclusive	Inconclusive
Shared	Inconclusive	Lower proportion	n/a
Hospital	Insufficient data	Insufficient data	Inconclusive
Reporting Delay	Shorter delay	Shorter delay	Slightly shorter delay
Nominal defendant	Inconclusive	Insufficient data	n/a
Cost	Lower average cost	Lower average cost	Inconclusive

Bushfire (results across 7 events covering all states – 4 of these were long duration events)

Characteristic Analysed	*NSW (3 events)*	*QLD (1 event)*	*VIC (3 events)*
Frequency	Lower	Higher	Higher
Age	A mixed picture: More U15s, 20-25, 50-60 Fewer 40-50	Insufficient data	A mixed picture: More U15, 50-60 Fewer 15-20, 40-50, 60+
Gender	Inconclusive	Insufficient data	Slightly higher proportion of males
Injury Severity *(MAIS category)*	Inconclusive	More high severity (4) More fatalities (6)	More fatalities (6) Rest inconclusive
Whiplash	Inconclusive	Inconclusive	Inconclusive, possibly fewer
Claimant Role	More motorcyclist, passenger Fewer driver, pedestrian	More passengers Fewer pedestrian	More pedestrians Fewer cyclists, motorcyclists, tram/train
Brain Injury	Insufficient data	Insufficient data	Sparse data, possibly low
Legal Representation	Inconclusive	Less	Higher proportion
Shared	Slightly lower proportion	Inconclusive	n/a
Hospital	Insufficient data	Insufficient data	Inconclusive
Reporting Delay	Inconclusive	Inconclusive	Longer delay
Nominal defendant	Inconclusive	Insufficient data	n/a
Cost	Inconclusive	Slightly higher average cost	Inconclusive

Heatwave (results across 14 events covering all states)

Characteristic Analysed	*NSW (5 events)*	*QLD (4 events)*	*VIC (5 events)*
Frequency	Inconclusive	Lower, mixed	Inconclusive
Age	Inconclusive	More 15-20, 40-50 Fewer U15, 20-30 and 70+	Slightly more U20 and 25-30 Fewer 30-60
Gender	Inconclusive	Inconclusive, possibly higher proportion of males	Inconclusive
Injury Severity *(MAIS category)*	More high severity (3, 4, 5)	More high severity (5) More fatalities (6)	Inconclusive
Whiplash	Inconclusive	Inconclusive	Lower proportion
Claimant Role	More motorcyclist, pedestrian Slightly fewer driver	More cyclist Fewer pedestrian	More tram/train Fewer pedestrian, motorcyclist
Brain Injury	Sparse data, possibly higher proportion	Sparse data, possibly higher proportion	Insufficient data
Legal Representation	Inconclusive	Inconclusive	Inconclusive
Shared	Inconclusive	Lower proportion	n/a
Hospital	Insufficient data	Insufficient data	Inconclusive
Reporting Delay	Inconclusive	Inconclusive	Inconclusive
Nominal defendant	Lower proportion	Insufficient data	n/a
Cost	Higher average cost	Generally lower average cost	Generally lower average cost

Earthquake (results for a single event in NSW only)

Characteristic Analysed	***NSW (1 event)***	***QLD (No events)***	***VIC (No events)***
Frequency	Lower		
Age	More 15-20		
Gender	Possibly more males		
Injury Severity (MAIS category)	More high severity (4, 5)		
Whiplash	Lower proportion		
Claimant Role	More passenger Fewer driver, pedestrian, motorcyclist		
Brain Injury	Insufficient data		
Legal Representation	Inconclusive		
Shared	Inconclusive		
Hospital	Insufficient data		
Reporting Delay	Longer delay		
Nominal defendant	Higher proportion		
Cost	Higher average cost		

Appendix C. Summary of workers compensation analysis results

A summary of our analysis results for each event type is provided below. Comments have only been included in the tables for the variables where there was evidence of differences between the experience for the event periods and the periods each was matched with.

For some of the characteristics we examined the data was quite sparse and hence the results were inconclusive (e.g. impacts on claims for the smaller industries, numbers of fatal and permanent total incapacity claims, work days lost).

We also examined a variety of variables which captured details of the accident, such as accident type, location and agency. The availability of these varied by jurisdiction and so have only been populated where available.

Storm (results across 12 events covering all states)

Characteristic Analysed	*NSW (4 events)*	*QLD (3 events)*	*VIC (5 events)*
Frequency	Higher	Inconclusive	Higher
Age mix	Inconclusive	Lower 60+ Remainder little change	Lower 20-40 Higher 50+
Gender mix	Slightly greater proportion of females injured on event day	Inconclusive	Greater proportion of females injured on event day
*Employment type**	Lower proportion of part time workers injured	Insufficient data	Insufficient data
Industry	Lower proportion of claims in Agriculture, Health & Community Services, Retail Trade and Cultural & Recreational Services Higher proportion of claims in Accommodation & Restaurants, Communications, Manufacturing, Wholesale Trade, Finance & Insurance, Personal & Other Services and Police.	Lower proportion of claims in Agriculture, Forestry and Fishing Higher proportion of claims in, Accommodation & Restaurants, Finance & Insurance, Public Administration & Safety, Transport, Postal and Warehousing	Higher proportion of claims in Public Administration & Safety
*Injury code (NSW, VIC)**	Greater proportions of permanent total disability claims	Insufficient data	No change for temporary disability Other categories inconclusive
*Bodily location of injury (QLD, VIC, NSW)** *Note: NSW data is categorised post 1 July 1991*	More non-physical injuries Fewer neck injuries	More neck injuries Fewer non-physical injuries	More upper limb injuries Fewer trunk injuries
*Accident details:** *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*	Lower proportion on construction sites	Insufficient data	More using unpowered tools & appliances
Gross Incurred Cost	Slightly higher average cost	No clear cost trend	Slightly lower average cost

Note:
In NSW the analysis generally combines public sector data from the TMF and private sector data NSW WorkCover; the fields marked with a * only include the NSW WorkCover data.

Hail (results across 5 events covering NSW and QLD only)

Characteristic Analysed	NSW (2 events)	QLD (3 events)	VIC (No events)
Frequency	Higher, mixed	Inconclusive	
Age	Higher U20 Remainder inconclusive	Inconclusive	
Gender	Slightly higher proportion of females injured on event day	Lower proportion of females injured on event day	
*Employment type**	Inconclusive	No data	
Industry	Lower proportion of claims in Education, Communications, Police Higher proportion of claims in Manufacturing, Health, Finance & Insurance, Community Services, Personal & Other Services and Property & Business	Lower proportion of claims in Education & Training Higher in Arts & Recreation Services	
*Injury code (NSW)**	Lower proportion of permanent partial disability claims	Insufficient data	
*Bodily location of injury (NSW, QLD)** *Note: NSW data is categorised post 1 July 1991*	More neck injuries Other categories inconclusive	Fewer non-physical injuries Other categories inconclusive	
*Accident details:** *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*	Lower proportion on construction sites & in moving transport Greater proportion in public thoroughfares Remainder inconclusive	Insufficient data	
Gross Incurred Cost	Slightly lower average cost	Higher average cost	

Cyclone (results across 2 events in Queensland only)

Characteristic Analysed	NSW (No events)	QLD (2 events)	VIC (No events)
Frequency		Higher	
Age		Little change in mix of claims by age	
Gender		Slightly higher proportion of females injured on event day	
Employment type		No data	
Industry		More Agriculture, Administration & Support Services, Retail Trade, Professional, Scientific & Technical Services Fewer Transport, Postal & Warehousing and Wholesale Trade	
Bodily location of injury (QLD)		More head, neck & multiple injuries Other categories inconclusive	
Accident details: *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*		Insufficient data	
Gross Incurred Cost		Higher average cost Also more zero claims	

Flood (results across 11 events covering all states)

Characteristic Analysed	***NSW (4 events)***	***QLD (3 events)***	***VIC (4 events)***
Frequency	Lower	Lower, Mixed	Lower
Age	Inconclusive	Higher 50-60	Lower U50 Higher 60+
Gender	Higher proportion of females injured on event day	Greater proportion of females injured on event day	Inconclusive
*Employment type**	Greater proportion of part time workers injured on event day	Insufficient data	Insufficient data
Industry	Lower proportion of claims in Education Higher proportion of claims in Mining, Retail, and Personal & Other Services	Lower proportion of claims in Construction, Manufacturing Higher proportion of claims in Accommodation and Food Services, Health Care and Social Assistance, Mining, Public Administration and Safety, Retail Trade, Information, Media & Telecommunications	Lower proportion of claims in Transport, Postal & Warehousing and Wholesale Trade More in Administration & Support Services
*Injury code (NSW, VIC)**	Lower proportion of permanent partial disability claims	Insufficient data	Higher proportion of permanent partial disability claims
*Bodily location of injury (NSW, QLD, VIC)** *Note: NSW data is categorised post 1 July 1991*	More neck & multiple injuries Fewer head injuries	More non-physical and multiple injuries Fewer head injuries	Slightly more neck injuries
*Accident details:** *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*	Lower proportion on construction sites Greater proportion in public thoroughfares and on transport	Insufficient data	Fewer body stressing More falls, slips & trips, mobile plant & transport and environmental agencies Fewer unpowered tools & appliances and materials & substances
Gross Incurred Cost	Lower average cost	Higher average cost Also more zero claims	Lower average cost

Bushfire (results across 7 events covering all states – 4 of these were long duration events)

Characteristic Analysed	***NSW (3 events)***	***QLD (1 event)***	***VIC (3 events)***
Frequency	Lower	Inconclusive	Mixed, inconclusive
Age	Higher U20	Higher 60+ Remainder inconclusive	Inconclusive
Gender	Inconclusive	Slightly greater proportion of females injured on event day	Slightly greater proportion of females injured on event day
*Employment type**	Higher proportion of part time workers injured	Insufficient data	Insufficient data
Industry	Lower proportion of claims in Cultural & Recreational Services, Transport & Storage and Education. Higher proportion of claims in Agriculture, Accommodation & Restaurants, Retail Trade, Wholesale Trade, Manufacturing and Ambulance Services, Police and Fire Brigades.	Insufficient data	Lower proportion of claims in Education & Training, Healthcare & Social assistance, Transport, Postal & Warehousing and Other Services Higher proportion of claims in Agriculture, Finance & Insurance and Public Administration & Safety
*Injury code (NSW, VIC)**	Inconclusive	Insufficient data	Higher proportion of permanent partial disability claims
*Bodily location of injury (NSW, QLD, VIC)** *Note: NSW data is categorised post 1 July 1991*	Fewer non-physical injuries	Fewer head, upper limb and multiple injuries More neck and non-physical injuries.	Fewer head & multiple injuries More neck and non-physical injuries
*Accident details:** *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*	Higher proportion on construction sites & public thoroughfares Lower proportion on transport	Insufficient data	More from heat, radiation & electricity, falls slips & trips, mental More environmental agencies Fewer mobile plant & transport
Gross Incurred Cost	Slightly higher average cost	Slightly higher average cost	Inconclusive

Heatwave (results across 14 events covering all states)

Characteristic Analysed	***NSW (5 events)***	***QLD (5 events)***	***VIC (5 events)***
Frequency	Lower	Lower	Mixed, inconclusive
Age	Higher U40 Remainder inconclusive	More 60-70 Rest inconclusive	More 50-60 Rest inconclusive
Gender	Slightly greater proportion of males injured on event day	Slightly greater proportion of males injured on event day	Inconclusive
*Employment type**	Higher proportion of part time workers injured on event day	Insufficient data	Insufficient data
Industry	Lower proportion of claims in Health, Education and Transport Higher proportion of claims in Construction, Accommodation & Restaurants, Manufacturing, Community Services, Police and Fire Brigades	Lower proportion in Education & Training and Transport, Postal & Warehousing Higher proportion of claims in, Accommodation & Food Services and Arts & Recreation Services	Lower proportion in Construction and Transport, Postal & Warehousing Higher proportion of claims in Manufacturing and Other Services
*Injury code (NSW, VIC)**	Lower proportion of permanent partial disability claims	Insufficient data	Little change for temporary disability claims Other categories inconclusive
*Bodily location of injury (NSW, QLD, VIC)** *Note: NSW data is categorised post 1 July 1991*	Fewer injuries to the head & trunk and fewer non-physical injuries More lower limb injuries	Fewer neck injuries and non-physical injuries	Fewer lower limb injuries More non-physical injuries
*Accident details:** *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*	Higher proportion on construction sites & on moving transport	Insufficient data	More from being hit by moving object and chemical & substances More from heat, radiation & electricity, more biological Fewer falls, trips and slips
Gross Incurred Cost	Slightly lower average cost	Inconclusive	Slightly lower average cost

Earthquake (results for a single event in NSW only)

Characteristic Analysed	***NSW (1 event)***	***QLD (No events)***	***VIC (No events)***
Frequency	Lower		
Age	Inconclusive		
Gender	Much higher proportion of females injured		
*Employment type**	Higher proportion of part time workers injured		
Industry	Insufficient data		
*Injury code **	More fatalities Rest inconclusive		
*Bodily location of injury** *Note: NSW data is categorised post 1 July 1991*	Insufficient data		
*Accident details:** *- Location & Duty Status (NSW)* *- Type & Agency (VIC)*	Insufficient data		
Gross Incurred Cost	Slightly higher average cost		