



## Associations between extreme bushfires and Emergency Responders' compensated injury and illness in Victoria, Australia.

Berecki-Gisolf, Janneke, Win Wah, Malcolm R. Sim, Deborah C. Glass, Ryan F. Hoy, Tim Driscoll, Alex Collie, and Karen Walker-Bone. "[First responders' occupational injury and disease associated with periods of extreme bushfires.](#)" *Scientific Reports* 14, no. 1 (2024): 23305.

### Introduction

There have been studies of the health effects of bushfire smoke exposure in firefighters and of the psychological impacts of ERs. However, less is known about the effects of extreme bushfire events on emergency responders, in terms of injury and illness occurring whilst performing their duties or delayed onset effects.

After the Fires ([ESF have a knowledge digest in this study](#)) is a similar study but used interview and survey data to establish the mental health impacts of the Black Summer bushfires on emergency responders. The effects of extreme bushfires on mental health *in comparison to* normal duties have, as yet, not been established. This is the first study that uses compensation claims to link injury/disease and ER workers' characteristics to periods of extreme bushfires.

### Purpose of study

This study is a retrospective analysis of workers' compensation claims to assess the associations of occupational injury and disease with periods of extreme bushfires.

### Method

Logistic regression modelling was used to identify factors associated with compensation claims. The data examined extreme bushfire periods in 2009 and 2019/20, compared to all other claims, and adjusted for seasonality (summer).

- **Parameters:**
  - *Extreme bushfire periods* - defined as claims with an injury/disease date that coincided with the Black Saturday bushfires in Victoria: 7 February – 14 March 2009, or the Black Summer bushfires in Victoria: 1 November 2019–29 February 2020.
  - *Summer claims* - determined from injury/disease dates occurring in December, January or February.<sup>1</sup>
- **Data source:** WorkSafe Vic supplied compensation claim data based on the date the insurer received the claim (between 1 January 2005 to 28 April 2023).
- **Sample:** 44,164 claims were included in the study. The claimant had to be 18 years or older at the time of injury and occupations were a) ambulance officers and paramedics; b) police officers; and c) firefighters<sup>2</sup> in the state of Victoria.

<sup>1</sup> Extreme bushfire period claims mostly, but not entirely, overlapped with summer months in Victoria: to preserve the completeness of the summer months descriptive statistics, claims that occurred during periods of extreme bushfire were not excluded from the summer month claims.

<sup>2</sup> Based on Australian and New Zealand Standard Classification of Occupations (ANZSCO) codes 4412 (Fire and Emergency Services); 4413 (Police); 4111 (Ambulance Officers and Paramedics).



**Exclusions:** The results of this study do not reflect emergency services workers who are volunteers. Defense force personnel who were emergency responders in Victoria were not included in the analysis as Australia has a dedicated Military Compensation Scheme.

**Study strengths:**

- Good sample size
- Population-based design
- Specificity in terms of exposure time periods (comparing to other time periods and adjusting for seasonality)
- Selection of relevant occupational groups.

**Study limits:**

*Data is correlational:* cannot confirm that these claims were directly caused by extreme bushfires. Other challenges such as extreme weather, stress and anxiety in the community and possibly disorderly conduct in the public may have contributed.

*Black Sat overlap with start of the COVID-19 pandemic:* Though the pandemic had a profound effect on health service use, this study used injury/disease onset dates in November 2019-February 2020 as markers for the second of the two extreme bushfire periods. This method is unlikely to be directly affected by the pandemic, which did not take hold in Victoria until after February 2020.<sup>3</sup>

*Bias to underclaiming:* The results presented in our study could be an underestimate of the incidence of work-related mental health issues in this group; however, there is no evidence to suggest that the associations presented in the modelling (i.e. the internal consistency of the data) is affected by under-claiming.

*Largely exclude volunteer experience:* While volunteer firefighters are covered by under the volunteer firefighter compensation scheme, data for volunteer firefighters were not routinely captured in the Victorian workers' compensation data.

*No direct exposure data:* As a retrospective analysis, the study may not indicate direct exposure to the Black Saturday or Black Summer bushfires. There was no data on place of exposure and exact time of day nor confounding variables such as previous injury/disease occurrences, extreme weather-induced behaviour change, job stress, or spikes in working hours during extreme bushfires.

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<sup>3</sup> A slight under-estimate of work-related injury/disease associated with this time period is conceivable: service use may have been impacted by COVID in the months following the bushfire exposure, and therefore, injured workers may have been less likely to reach the medical expense threshold to qualify for claiming compensation. The results presented here can, therefore, be considered robust, while the underlying associations may have been underestimated.



However, as the study was conducted state-wide at a population level, the *authors claim the presented statistically significant findings are robust* and overall association is likely to be related to the extreme bushfires, given the occupational sectors selected for this analysis.

## Data and findings

Annex A presents a full table of findings. The high level findings were:

- 1105 (2.5%) had recorded injury/disease onset dates within extreme bushfire periods, and 11,642 (26.4%) occurred in summer months.
- Over half of claims were made by police (52.4%), followed by ambulance officers/paramedics (27.2%) and firefighters (20.5%).
- Extreme bushfire period claims were associated with older workers (odds ratio/OR = 1.58, 95%CI = 1.30–1.92, ages  $\geq 55$  vs. 35–44 years).
- Mental disorders (OR = 1.61, 95%CI = 1.25–2.07), intracranial injuries (OR = 3.04, 95%CI = 1.69–5.48) and infections/parasites (OR = 3.11, 95%CI = 1.61–5.98) vs. wounds were associated with extreme bushfire period claims.

## Findings

The key findings from the statistical findings are that:

- Older workers were disproportionately impacted, as evidenced from injury and disease workers' compensation claim rates.
- Injury/diseases were most likely to be caused by mental stressors (and also by heat/radiation/electricity).
- Mental disorders constituted a relatively large proportion of all claims (17%), whereas intracranial injuries and infections/parasites were relatively rare (0.5% each).
- During periods of extreme bushfires (compared with regular bushfire periods), workers' compensation claims were most common for mental disorders, intracranial injuries and respiratory diseases.

### Older workers:

The reasons for why older workers have more claims are multiple, and could include:

- Potentially increased participation in emergency response, especially because resources are stretched during extreme bushfire periods;
- Working longer shifts;
- Being more likely to have chronic health conditions which may put them at higher risk of work-related injury and disease.
- Related to the above, a cumulative effect on mental and physical health is more likely if older workers had already been exposed to multiple extreme bushfires.



## Discussion

The finding that there is an increase in older workers' claims during extreme bushfires highlights the importance of providing additional supports and services to older workers. This is especially important consider the reliance of the sector on older workers, and especially so in the context of an ageing workforce population.<sup>4</sup>

The authors conclude by suggesting that "(p)reparedness for extreme bushfires could include tailored prevention measures for emergency responders aged 55 years and above. This could be achieved through pre-deployment medical assessment for older emergency responders, as well as improved periodic physical and mental health surveillance at work. The latter could be offered as a virtual tool to further lower barriers to participation".

## Ideas for further research

The authors also point to the potential for more research, specifically:

1. "a large, prospective cohort studies with long follow-ups and the use of wearable monitors for exposure tracking...to assess the direct exposure to extreme bushfires and the effects of cumulative exposures among emergency responders."
2. "a study of volunteer firefighters' workers compensation claims in relation to extreme bushfire periods" to better understand the differences in health impacts of extreme bushfires based on differences<sup>5</sup> between the two groups.

## Conclusion

This study provides quantitative evidence that, compared to regular bushfire seasons, claims due to mental illnesses and disorders were *significantly more likely* to arise in extreme bushfire periods *and* that extreme bushfires are expected to become increasingly frequent with the effects of climate change.

The overall findings of this study will be unlikely to surprise the reader. We know that mental disorders are of particular concern for front-line bushfire firefighters (in addition to physical hazards such as smoke exposure, intense heat, low oxygen, excess noise and long working hours with limited rest). For the average reader, the value of this study lies in providing hard data for justifying the ongoing need to allocate budget for mental health initiatives, pre and post incident, and for primary and secondary supports.

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<sup>4</sup> This is not only for the emergency services. Nationally, the workforce is ageing in the mid-1990s, workers aged 50–64 years accounted for 11% of employed persons; in 2023, this percentage had increased to 21%. Workers' compensation claims rates (per hours worked in each age group) have been reported to increase with age, reaching a maximum rate in workers aged in their early 60s for the overall Victorian working population.

<sup>5</sup> Firefighters typically serve on a part-time basis and often have other primary occupations, while professional firefighters are more likely to serve full-time and respond to a higher volume and variety of emergency situations.



## Annex A: Findings in detail.

Table of findings: Worker, work, injury/disease and claim related factors in all claims, claims that arose during summer and those that arose during extreme bushfire periods

	Univariate		Multivariable: Sociodemographic factors Occupation Injury/disease Claim type		Multivariable: Sociodemographic factors Occupation Cause/mechanism Claim type	
	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
<i>Worker factors</i>						
<i>Age at injury</i>						
< 25 yrs	1.28	[0.94, 1.73]	1.14	[0.83, 1.56]	1.17	[0.86, 1.61]
25-34 yrs	1.13	[0.95, 1.33]	1.12	[0.94, 1.33]	1.13	[0.95, 1.35]
35-44 yrs	1[REF]		1 [REF]		1[REF]	
45-54 yrs	1.11	[0.94, 1.30]	1.10	[0.93, 1.29]	1.09	[0.92, 1.29]
≥ 55 yrs	1.60	[1.32, 1.92]*	1.58	[1.30, 1.93]*	1.58	[1.30, 1.92]*
<i>Sex</i>						
Male	1[REF]		1 [REF]		1[REF]	
Female	1.00	[0.87, 1.14]	1.09	[0.94, 1.27]	1.08	[0.93, 1.26]
<i>Regionality</i>						
Major Cities	1[REF]		1 [REF]		1[REF]	
Inner Regional	1.17	[1.03, 1.34]*	1.14	[0.98, 1.32]	1.14	[0.99, 1.33]
Outer Regional/Remote	1.18	[0.93, 1.49]	1.03	[0.79, 1.34]	1.03	[0.79, 1.35]
<i>Socio-economic Index for Area</i>						
Quintile 1	1.13	[0.89, 1.42]	0.94	[0.73, 1.21]	0.94	[0.72, 1.21]
Quintile 2	1.14	[0.93, 1.39]	1.00	[0.80, 1.25]	1.00	[0.80, 1.25]
Quintile 3	1.03	[0.87, 1.23]	0.94	[0.79, 1.14]	0.95	[0.79, 1.14]
Quintile 4	1.18	[1.00, 1.38]	1.15	[0.98, 1.36]	1.14	[0.97, 1.34]
Quintile 5	1[REF]		1 [REF]		1[REF]	
<i>Work factors</i>						
<i>Occupation</i>						
Ambulance officers and paramedics	0.93	[0.81, 1.08]	0.91	[0.78, 1.07]	0.92	[0.78, 1.08]
Police officers	1[REF]		1 [REF]		1[REF]	
Firefighters	1.25	[1.08, 1.45]*	1.19	[1.01, 1.40]*	1.19	[1.02, 1.40]*
<i>Injury/disease factors</i>						
<i>Reported season of onset</i>						
Summer	8.97	[7.81, 10.29]*	8.94	[7.79, 10.26]*	8.92	[7.77, 10.24]*
Autumn, winter, spring	1[REF]		1 [REF]		1[REF]	
<i>Cause</i>						
Falls, slips and trips	1[REF]				1[REF]	
Hitting object	0.98	[0.67, 1.43]			1.04	[0.71, 1.53]
Being hit by moving object	0.98	[0.76, 1.26]			1.00	[0.77, 1.30]
Sound and pressure	0.82	[0.45, 1.49]			0.68	[0.36, 1.28]
Body stressing	1.04	[0.86, 1.26]			1.15	[0.95, 1.40]
Heat, radiation and electricity	3.17	[2.07, 4.86]*			1.95	[1.26, 3.03]*
Chemicals and substances	1.16	[0.78, 1.73]			1.05	[0.70, 1.58]
Biological	0.60	[0.36, 0.99]			0.72	[0.43, 1.21]
Mental	1.66	[1.35, 2.04]*			1.65	[1.32, 2.05]*
Other	0.85	[0.62, 1.18]			0.79	[0.57, 1.10]
<i>Injury/disease type*</i>						
Intracranial Injuries	2.87	[1.63, 5.06]*	3.04	[1.69, 5.48]*		



Fractures	1.13	[0.77, 1.66]	1.17	[0.79, 1.73]			
Wounds	1[REF]		1 [REF]				
Burns	1.62	[0.72, 3.63]	1.33	[0.58, 3.03]			
Other injuries	1.24	[0.87, 1.75]	1.15	[0.81, 1.63]			
Traumatic joint, ligament, muscle tendon	0.95	[0.74, 1.21]	1.04	[0.81, 1.33]			
Musculoskeletal system	1.01	[0.81, 1.25]	1.09	[0.87, 1.37]			
Mental disorders	1.62	[1.29, 2.04]*	1.61	[1.25, 2.07]*			
Digestive system	1.58	[0.91, 2.77]	1.60	[0.89, 2.85]			
Skin and subcutaneous tissue	0.85	[0.29, 2.51]	0.76	[0.26, 2.27]			
Nervous or sensory organs	1.09	[0.67, 1.75]	0.97	[0.59, 1.60]			
Continued							

\*Injury to nerves and spinal cord are grouped with other injuries due to small cells. *Cell suppression* is indicated where cells are suppressed not due to low cell counts, but to prevent low counts in other cells being re-calculated by subtraction from the total. † $p < 0.05$  or ‡ $p < 0.0001$  statistical difference between this group and all other claims in chi-square testing.