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Associations between workers' compensation and self-harm: A retrospective case-series study of hospital admissions data

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Summary

Background While workers' compensation schemes aim to assist and support injured workers, there is some evidence that the process of pursuing a compensation claim may be extremely stressful for workers. This research aimed to compare hospital admissions for self-harm among workers' compensation claimants and non-claimants.

Methods A retrospective case-series design, this study used hospital admissions data for 42,567 patients (2011-2018) to estimate rates of hospital admission for intentional self-harm and 'self-harm and probable self-harm' (due to intentional self-harm, poisoning, or undetermined intent) and compare these between workers' compensation claimants and non-claimants. Rates were stratified by gender and calculated for each age group.

Findings For males, there was no observable difference between claimants and non-claimants for admission due to intentional self-harm. For female claimants, the incidence rate for admission for intentional self-harm was higher than non-claimants (rate ratio (RR) 2.4, 95%CI 1.8-3.2, risk difference (RD) 47.7 per 100,000 person-years). For the combined category of 'self-harm and probable self-harm', the incidence rate was elevated in both male (RR 5.8, 95%CI 5.0-6.6, RD 167.7 per 100,000 person-years) and female workers' compensation claimants (RR 3.4, 95%CI 2.8-4.2, RD 114.8 per 100,000 person-years) relative to non-claimants.

Interpretation Female workers' compensation claimants appear to have elevated rates of admission for intentional self-harm and 'self-harm and probable self-harm' compared to non-claimants. Male claimants appear to have increased rates of hospital admission for 'self-harm and probable self-harm'. This suggests that the process of pursuing workers' compensation may be associated with increased risk of self-harm, and highlights a need for further research.

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Introduction

Globally, workplace injuries are estimated to be responsible for 8.8% of the global burden of mortality, and 8.1% of the combined global burden of morbidity and mortality.[1] In Australia, the economic cost of work related injuries was estimated to be $61.8 billion in 2012/13, the equivalent of 4.1% of gross domestic product.[2]

In many high-income countries, those injured at work have access to workplace injury compensation schemes. In Australia, employers have a statutory requirement to pay workers' compensation insurance for injuries sustained by their employees in the course of their work activities,[3] and most Australian workers (94.4%) are covered by these schemes.[2] The central remit of these schemes is to compensate for loss of earnings while the injured worker is unable to work, and assist with rehabilitation and medical costs associated with the injury. As in many other developed countries, workers' compensation benefits in Australia are

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Research in context

Evidence before this study

There is some evidence that workers' compensation schemes are associated with adverse health outcomes among claimants. It is also known that some claimants experience the claims process as highly stressful.

Added value of this study

This the first study that we are aware of to examine rates of hospital admission for self-harm among workers' compensation claimants and compare them to the rates among non-claimants. To probe potential misclassification of self-harm, we examined admissions for both intentional self-harm, and a broader category of 'self-harm and probable self-harm'. Our results showed that females, but not males, who are claimants of workers' compensation have elevated rates of hospital admission for intentional self-harming events, while both male and female claimants have elevated rates of admission due to 'self-harm and probable self-harm'.

Implications of all the available evidence

The work contributes to growing evidence that engagement with workers' compensation schemes is associated with poorer health outcomes for claimants. Research is needed to examine and identify the causal factors that may contribute to the elevated rates of hospitalisation for self-harm among workers' compensation claimants. Regardless of the specific factors underpinning the association between workers' compensation and hospital admission for self-harm, workers' compensation schemes should strive to minimise stress among claimants.

calculated according to pre-injury wages. By contrast, public disability or welfare benefits are means tested and typically much lower than those provided by workers' compensation schemes. For most injured workers who are unable to work then, workers' compensation is financially desirable over social welfare.

Workers' compensation schemes vary across the world, and across country jurisdictions. In Australia, compensation schemes differ across states, for example, in terms of the rate and duration of benefit, care and assistance provisions, classification of impairments, definitions of work and workers, and waiting periods for payment of income replacement.[4] Contrary to what might be expected, there is growing evidence that workers' compensation (the pursuit or receipt of compensation), may be negatively associated with health outcomes both in Australia,[5] as well as internationally such as in Canada[6] and the United States.[7]

A systematic review of the international literature examining the association between compensation (workers' compensation or litigation or both) and surgical outcomes, found consistent evidence that compensation was associated with poorer surgical outcomes.[8] Of the 211 included studies, 175 found an adverse relationship between compensation and surgical outcomes, and meta-analysis showed that patients who were compensation claimants had over three times the odds of having unsatisfactory surgical outcomes compared to those who were not compensated.[8] A study comparing the long term (10–28 years post injury) polytrauma outcomes of workers' compensation and non–workers' compensation patients found significantly poorer outcomes among the workers' compensation patients (on both subjective and objective outcome measures.[9]

Why poorer recovery and health outcomes might be observed in those who are workers' compensation claimants has led to the proposition that workers' compensation schemes may, in fact, exert damaging health effects on those they ostensibly aim to protect and serve. Disentangling the different components involved in this relationship — work injury, compensation, recovery — to understand the nature of this relationship is challenging. One vein of inquiry has proposed that the compensation system itself, in particular the legal and administrative processes involved, may be harmful to claimants.[10]

It is known that for many claimants in Australia, the experience of workers' compensation can be highly stressful,[5,11] and many report perceptions of injustice, hostile interactions and poor claims administration.[12] Studies of compensation claimants within Australia (drawing on mixed samples of both transport accident and workers' compensation schemes) have found associations between compensation and post-traumatic stress disorder,[13] and have identified that the stress of engaging with compensation schemes and the continued requirement to demonstrate incapacity can negatively impact on long-term recovery, with sustained effects observed on symptoms of depression and anxiety.[14] It is possible that the stress associated with the claims process is such that it also contributes to self-harming and suicidal behaviours. Acknowledging that compensation systems are not homogenous (even within countries such as Australia, systems vary across jurisdictions), some international evidence supports this stress. Qualitative work in Canada that examined workers' experiences of the compensation system found that adverse mental health outcomes were the most common health effects that workers attributed to the process, with some reporting suicidal ideation.[6] In the US, a record linkage study found increased suicide (and drug-related) mortality among workers' compensation claimants with lost-time injuries requiring more than 7 days from work (compared to claimants requiring less than 7 days).[7]

Comparative studies of outcomes of workers' compensation claimants and non-claimants are needed to

assess whether workers' compensation is associated with adverse outcomes, and the extent of any such relationships. This represents an important research gap that we aimed to address by using hospital admissions data to examine the relationship between workers' compensation and hospital admissions for self-harm.

Our specific study aims were to compare workers' compensation claimants and non-claimants in relation to admissions to hospital for 1) intentional self-harm and 2) 'self-harm and probable self-harm' (intentional self-harm/poisoning/undetermined intent). We included cases of poisoning and undetermined intent to account for possible misclassification of cases where intent was unclear.

Methods

Utilising a retrospective case-series design,[15] we carried out analysis of hospital admissions data for patients in Victoria, Australia. Ethics approval was granted by the University of Melbourne Human Research Ethics Committee (#13022). As we used administrative data, it was not possible to obtain patient consent for this research.

Data sources

In-patient data from the Victorian Admitted Episode Dataset (VAED) were obtained from the Centre for Victorian Data Linkage (CVDL). This dataset consisted of records for patients admitted and discharged from all public and private hospitals in Victoria linked at the patient level. While all Australians are entitled to free healthcare at public hospitals under the publicly funded Medicare scheme, private healthcare can be privately accessed in private hospitals through private healthcare insurance schemes. The inclusion of both public and private hospitals in the VAED dataset ensures comprehensive coverage of all admissions to Victorian hospitals. Admission records included up to forty codes from the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD10-AM).[16] Other information from the VAED records that were used in the analysis included the date of episode and discharge, age, gender, and compensable status.

Case definition

We constructed an individual-level dataset containing hospital admissions for self-harm for the financial years (1 July to 30 June) 2011/2012 until 2017/2018 for the Australian state of Victoria. To mitigate the possibility of readmission skewing results, we used first admissions in the analysis. We defined admission as the first admission per person, per year, per compensable status. Analysis was restricted to patients aged between 15 and 69 years at admission. We used two ways of selecting cases, which we label 'intentional self-harm' and 'self-harm and probable self-harm'. Hospital admissions for intentional self-harm were identified using ICD-10 codes X60-X84, which capture intentional self-harm. It is often difficult to ascertain intent in suspected suicide and self-harming cases, and internationally, there is increasing evidence of misclassification and under-counting of suicide mortality,[17–19] as well as self-harm in hospital presentations.[20] Specifically, there is some evidence that some deaths due to accidental poisoning/overdose,[17,18,21,22] and cases where there is indeterminate intent[19] are in fact suicides, but are misclassified as poisoning or undetermined intent. This has led to calls for closer attention to be paid to overdoses and deaths of undetermined intent when examining suicide.[21] The risk of misclassification of intent is also important when considering hospital admissions for self-harm as it may obscure associations between workers' compensation and hospital admission for intentional self-harm. To probe potential misclassification of self-harm, we also selected a broader group of diagnoses. These were T36-T50 (poisoning by adverse effect of and underdose of drugs, medicaments, and biological substances) and Y10-Y34 (event of undetermined intent). See Table 1 for the codes included in each outcome, and Supplementary Material A for further information on the ICD-10 codes used in these analyses.

Using the classification defined above, we selected all episodes where at least one of these ICD-10 codes was included in the diagnosis fields (noting that it was possible for an individual patient to receive multiple ICD-10 codes for an individual episode).

Workers' compensation

The VAED dataset contained information on compensable status. Information on whether a patient is a claimant for either workers' compensation, transport accident compensation or veterans' compensation is collected upon admission to hospital by hospital staff, and is thereafter contained in patient records for the duration of the admission. Based on information in this field we selected all those identified as being a claimant of workers' compensation, thus defining the workers' compensation group as claimants of the workers'

Intentional self-harm (primary outcome)	Self-harm and probable self-harm (secondary outcome)
X60-X84: Intentional self-harm	X60-X84: Intentional self-harm Y10-Y34: Event of undetermined intent T35-T50: Poisoning by drugs, medicaments, and biological substances

***Table 1*: ICD-10 codes included in each outcome.**

compensation scheme when they were admitted to hospital. We compared this group to all other patients. This comparison group included patients without compensation as well as those compensable under other compensation schemes.

Statistical analysis

All analysis was conducted in R (4.1.1).[23] The information on compensable status in the VAED dataset allowed us to determine the numerators for people who were part of the workers' compensation schemes and those who were not. To calculate numerators for the incidence of self-harm, we allowed each patient to contribute a maximum of one admission episode of care per financial year and compensable group (no compensation vs. workers' compensation). A patient could contribute two admission episodes in the same year if their status changed from workers' compensation to no compensation between events, or vice versa. Patients whose status remained identical contributed only one admission episode in a year. We note that there was a total of 29 individuals who contributed twice in a year (that is, changed compensable status).

To derive denominators for the workers' compensation group, we obtained data on the number of people in Victoria with serious workers' compensation claims by 10-year age group, gender, and financial year from Safe Work Australia.[24] Safe Work Australia, is a statutory body with the remit to develop national policy related to workers' health and safety and workers' compensation. As part of this, they collect, analyse and report data related to workplace injury. In Australia in the years 2019–2020, there were 120,355 serious claims, equivalent to an incidence rate of 9.9 serious claims per 1000 employees.[25] In Victoria, a serious claim is one in which the accepted workers' compensation claim is for an incapacity that results in an absence from work of 10 days or more. In other jurisdictions around Australia, the incapacity must be a week or more, so Safe Work Australia standardises claim numbers from Victoria to ensure that they are comparable with those of other states. Census data from the Australian Bureau of Statistics was used to provide the denominator for the non-claimant Victorian population.

Self-harming behaviours are highly patterned by age and gender. We therefore calculated observed crude age- and gender-specific rates of hospital episode admissions for self-harm in 10-year age bands for workers' compensation claimants and non-claimants. We used direct standardisation methods to derive the standardised incidence rate by dividing the observed incidence by the expected admissions for both populations. To compare the incidence rates between patients who were claimants of workers' compensation and those patients not on workers' compensation, we also obtained the gender stratified rate ratio and the risk difference for each age group.

Role of funding source

The funders had no role in study design, data collection, data analysis, interpretation, writing of the report.

Results

Descriptive results

The sample comprised of 42,567 patients who had 50,205 admissions (first admission per year, per person, per compensable status) for injuries or conditions related to intentional self-harm, poisoning, or undetermined intent between 2011 and 2018. Of these 50,205 admissions, 292 were admissions for claimants and 49913 were admissions for non-claimants).

Table 2 provides an overview of patient characteristics for admissions to hospital for intentional self-harm, or 'self-harm and probable self-harm'. A higher proportion of males were observed among the workers' compensation claimants, and this group also contained a higher proportion of individuals in the older age groups than the non-claimant patients. Patients who were workers' compensation claimants had longer durations in hospital than non-claimants.

The incidence of poisoning and identifiable intentional self-harm among claimants was lower than among non-claimants, however the incidence of injuries with undetermined intent was higher among workers' compensation claimants.

Analytic results

Tables 3 & 4 display the overall and age-gender stratified incidence rates of hospital admissions for self-harm for females and males respectively (figures displaying these results are also presented as Figures S1 & S2 in the supplementary material), as well as estimates for the risk difference and rate ratio. We first focus on the primary outcome (intentional self-harm), and then present the results for the secondary outcome ('self-harm and probable self-harm': intentional self-harm/self-poisoning/indeterminate intent).

Rates of intentional self-harm in relation to workers' compensation. Irrespective of workers' compensation status, rates of intentional self-harm per 100,000 person-years were higher among females than among males, with younger females having higher rates than other groups.

The total incidence rate for admissions for intentional self-harm was 2.4 times higher (95%CI 1.8, 3.2) among female claimants than non-claimants. This translated to a risk difference of 47.7 (95%CI 23.3, 72.2),

		Workers' compensation claimant (n = 292)	Non claimant (n = 49913)
Age group (years)	15–19	<10	7670 (15.4%)
	20–29	64 (21.9%)	13379 (26.8%)
	30–39	76 (26%)	10190 (20.4%)
	40–49	62 (21.2%)	9447 (18.9%)
	50–59	77 (26.4%)	6622 (13.3%)
	60–69	<10	2605 (5.2%)
Gender	Female	92 (31.5%)	29002 (58.1%)
	Male	200 (68.5%)	20911 (41.9%)
Year	2011–12	51 (17.5%)	8523 (17.1%)
	2012–13	41 (14.0%)	5878 (11.8%)
	2013–14	33 (11.3%)	6157 (12.3%)
	2014–15	25 (8.6%)	6648 (13.3%)
	2015–16	40 (13.7%)	7321 (14.7%)
	2016–17	46 (15.8%)	7860 (15.7%)
	2017–18	56 (19.2%)	7526 (15.1%)
Intentional self-harm[a]		64 (21.9%)	30530 (61.2%)
Self-poisoning[a]		91 (31.2%)	41486 (83.1%)
Undetermined intent[a]		181 (62.0%)	10487 (21.0%)
Length of hospital stay Mean (SD)		6.377 (13.086)	3.303 (12.863)
Deceased (at any point during admission)		0 (0.0%)	462 (0.9%)

***Table 2*: Patient admission characteristics of all admissions for injuries or conditions related to intentional self-harm, self-poisoning, or undetermined intent.**

[a] It is possible for a patient to have all three ICD10 codes for one event.

meaning that there were 47.7 (per 100,000 person-years) more admissions for self-harm among workers' compensation claimants than would be seen in female non-claimants with the same age profile. For male claimants, however, the incidence rate was not observably different to non-claimants (rate ratio 1.0, 95%CI 0.7, 1.6 and risk difference 0.6, 95%CI −8.5, 9.8).

Among females, substantially increased rates of hospital admissions were observed among workers' compensation claimants aged 50–59 years (rate ratio 6.5, 95%CI 4.3, 9.6). The adjusted risk difference indicated

	Age (years)	Workers' compensation Rate (per 100,000) person years	Non-workers' compensation Rate (per 100,000 person years)	Rate ratio (CI)	Risk Difference (per 100,000 person years) (CI)
Intentional self-harm	<20	0 (0, 407.6)	91.7 (89.1, 94.4)	nc	−91.7 (−149.6, −33.8)
	20–29	22.2 (2.7, 80.1)	44.2 (43.0, 45.4)	0.5 (0.1, 2.0)	−22.0 (−58.3, 14.2)
	30–39	52.6 (17.1, 122.8)	28.4 (27.5, 29.4)	1.9 (0.8, 4.5)	24.2 (−27.2, 75.5)
	40–49	86.7 (46.2, 148.3)	31.5 (30.5, 32.5)	2.8 (1.6, 4.8)	55.3 (4.8, 105.7)
	50–59	144.4 (92.5, 214.9)	22.4 (21.5, 23.3)	6.5 (4.3, 9.6)	122.0 (61.3, 182.8)
	60–69	36.7 (4.4, 132.6)	8.3 (7.7, 9.0)	4.4 (1.1, 17.6)	28.4 (−31.7, 88.4)
	Total	81.4 (59.6, 108.6)	33.7 (33.2, 34.1)	2.4(1.8, 3.2)	47.7 (23.3, 72.2)
Self-harm and probable self-harm	<20	110.5 (2.8, 615.7)	112.5 (109.5, 115.4)	1.0 (0.1, 7.0)	−2.0 (−273.7, 269.8)
	20–29	77.6 (31.2, 159.8)	62.6 (61.2, 64.0)	1.2 (0.6, 2.6)	15.0 (−48.0, 78.0)
	30–39	168.3 (96.2, 273.4)	42.7 (41.6, 43.9)	3.9 (2.4, 6.4)	125.6 (37.9, 213.3)
	40–49	173.4 (113.3, 254.1)	44.7 (43.5, 45.9)	3.9 (2.6, 5.7)	128.8 (58.8, 198.7)
	50–59	228.6 (161.8, 313.8)	35.6 (34.5, 36.8)	6.4 (4.7, 8.8)	193.0 (117.4, 268.6)
	60–69	73.4 (20.0, 187.9)	16.3 (15.5, 17.2)	4.5 (1.7, 12.0)	57.1 (−24.0, 138.2)
	Total	162.8 (131.3, 199.7)	48.1 (47.5, 48.6)	3.4(2.8, 4.2)	114.8 (80.6, 148.9)

***Table 3*: Incidence rates of hospital admissions for intentional self-harm and 'self-harm and probable self-harm' for females.**

nc: denotes not computed because events in exposed group equal to zero.

	Age (years)	Workers' compensation Rate (per 100,000) person years	Non-workers' compensation Rate (per 100,000 person years)	Rate ratio (CI)	Risk Difference (per 100,000 person years) (CI)
Intentional self-harm	<20	0 (0, 141.9)	23.1 (21.9, 24.5)	nc	−23.1 (−43.7, −2.6)
	20–29	10.9 (1.3, 39.6)	22.3 (21.5, 23.1)	0.5 (0.1, 2.0)	−11.3 (−29.3, 6.6)
	30–39	19.5 (5.3, 50.0)	21.9 (21.1, 22.8)	0.9 (0.3, 2.4)	−2.4 (−24, 19.2)
	40–49	25.0 (9.2, 54.5)	21.2 (20.4, 22.1)	1.2 (0.5, 2.6)	3.8 (−18.3, 26)
	50–59	29.7 (11.9, 61.2)	14.5 (13.8, 15.3)	2.0 (1.0, 4.3)	15.2 (−9, 39.3)
	60–69	0 (0, 38.1)	6.6 (6.1, 7.2)	nc	−6.6 (−12.4, −0.9)
	Total	19.3 (11.6, 30.1)	18.6 (18.3, 19.0)	1.0 (0.7, 1.6)	0.6 (−8.5, 9.8)
Self-harm and probable self-harm	<20	153.8 (41.9, 393.9)	38.7 (37.1, 40.4)	4.0 (1.5, 10.6)	115.1 (−54.8, 285)
	20–29	312.1 (236.4, 404.3)	42.9 (41.8, 44.1)	7.3 (5.6, 9.4)	269.1 (185.5, 352.8)
	30–39	293.0 (223.6, 377.1)	41.8 (40.6, 42.9)	7.0 (5.4, 9.1)	251.2 (174.7, 327.7)
	40–49	150.3 (105.2, 208.0)	38.2 (37.0, 39.3)	3.9 (2.8, 5.5)	112.1 (60.9, 163.2)
	50–59	165.6 (117.7, 226.3)	28.5 (27.5, 29.6)	5.8 (4.2, 8.0)	137 (83.0, 191.1)
	60–69	41.3 (11.2, 105.7)	15.1 (14.2, 16.0)	2.7 (1.0, 7.3)	26.2 (−19.4, 71.8)
	Total	202.9 (175.8, 233.1)	35.2 (34.7, 35.7)	5.8 (5.0, 6.6)	167.7 (139.1, 196.3)

***Table 4*: Incidence rates of hospital admissions for intentional self-harm and 'self-harm and probable self-harm' for males.**
nc: denotes not computed because events in exposed group equal to zero.

that there were 122 extra admissions per 100,000 person-years for intentional self-harm among females receiving workers' compensation compared to female non-claimants aged 50–59 years.

Rates of 'self-harm and probable self-harm' in relation to workers' compensation. Overall, the incidence of hospital admissions with the combined 'self-harm and probable self-harm' was substantially elevated in both male and female workers' compensation claimants relative to non-claimants. For female claimants, the incidence rate for hospital admissions was 3.4 times higher (95%CI 2.8, 4.2) than non-claimants, with a risk difference of 114.8 (95% CI 80.6, 148.9) and for male claimants, the incidence rate was 5.8 times higher than non-claimants (95%CI 5.0, 6.6, and risk difference 167.7, 95%CI 139.1, 196.3).

Female claimants (Table 3) across all age groups from 30–39-years through to 60–69 years had increased incidence rates for hospital admissions for 'self-harm and probable self-harm'. As for intentional self-harm, this was particularly marked among female claimants aged 50–59-years (adjusted rate ratio 6.4, 95%CI 4.7, 8.8 and risk difference of 193.0, 95%CI 117.4, 268.6).

While male claimants (Table 4) across all age groups had increased rates of hospital admissions for 'self-harm and probable self-harm', this was especially pronounced among those aged 20–29 years (adjusted rate ratio 7.3, 95%CI 5.6, 9.4) and 30–39 years (adjusted rate ratio 7.0, 95%CI 5.4, 9.1), with an extra 269 and 251 admissions per 100,000 person years respectively for workers' compensation claimants compared to non-claimants in the same age groups.

Figures presenting the crude incidence rates for hospital admissions by age and gender are presented in the supplementary files (Figures S1 and S2).

Discussion

Main findings

This is the first study to examine the relationship between workers' compensation status and hospital admissions for intentional self-harm. For females, hospital admissions for intentional self-harm were elevated among those receiving workers' compensation. While for males there was no evidence that workers' compensation claimants had elevated rates of hospital admissions for intentional self-harm, there was evidence of increased hospital admissions for the broader outcome 'self-harm and probable self-harm'. Using the combined category of intentional self-harm/self-poisoning/undetermined intent, hospital admissions were elevated for females and males who were claimants of workers' compensation, relative to those who were not claimants.

Contextualising these results

On the basis of our results, it is plausible that the process of engaging with the workers' compensation is experienced as highly stressful for some claimants. Engaging with the compensation scheme can require ongoing and repeated checks and assessments. These checks and assessments can be stressful[11] and it is therefore possible that for a subset of these claimants,

this is associated with self-harming and suicidal behaviours and by extension, the higher rates of hospital admissions for self-harming injuries observed in this analysis. While this also aligns with the broader literature, there are other potential explanations, and we are unable to establish causality between workers' compensation and hospital admissions for self-harm. This highlights one of the key challenges in research of this kind, in particular, it is extremely difficult to distinguish the effects of the injury from the effects of the compensation process. To this end, Canadian research sought to distinguish between the effects of the injury and those of the compensation process itself, and found that the system was the greatest source of stress.[6] This Canadian work corroborated earlier work in Australia by Robert-Yates.[11] Despite this international evidence of the adverse effects of compensation systems, it is possible that the associations observed in our research are due to the injury itself, and not workers' compensation. Occupational injuries lead to a complex and inter-related set of social and psychological consequences across many domains, with implications for labour relations, community and social involvement, domestic and household involvement and family dynamics.[26] This has effects on psychological wellbeing, and it is known that compared to non-occupational injuries, occupational injuries are associated with an increased risk of depression.[27] In the case of severe injury, individuals may acquire a permanent disability or impairment. Research in the US reported increased mortality associated with the acquisition (due to work) of a disability related to low back strain.[28] Furthermore, 'disability identity' can shape a person's self-concept in both positive and negative ways.[29] It is possible that a disability acquired through a workplace injury profoundly and negatively shapes an individuals' perception of themselves and their capabilities, as well as their interaction and engagement with society, with negative mental health sequelae.

Another explanation for our findings is that of selection: that is, that those that enter the workers' compensation system as claimants are different to those that do not. For example, workers in roles or occupational settings that are dangerous, stressful, or poorly supported may experience poor mental health as a consequence of their workplace, and may also be more likely to experience workplace injury. A US study using three administrative datasets over 3 years found evidence of a reciprocal relationship between common mental health disorders and work-related injury, such that depression predicted work-related injury, and injury predicted depression.[30] The associations observed here cannot rule out such potential pathways and teasing out these relationships should be an important focus of future research.

A growing literature indicates that those engaging in Australian compensation schemes (transport accident and workplace injury compensation schemes) experience significant stress and have poor recovery outcomes.[14,31] While we are not aware of studies that have examined hospital admissions for self-harm among workers' compensation claimants, previous studies have demonstrated that those engaged in workers' compensation schemes have high levels of stress[11] and psychological distress.[32] That this process could be so stressful as to lead to self-harm and suicide is a proposition that warrants attention. Self-harm is increasingly conceptualised in terms of an iceberg model, with a large proportion of self-harming events hidden (below the water) and therefore not recognised.[33,34] While those presenting and admitted to hospital for self-harm are considered to represent the greatest risk in terms of suicide,[34] it is known that many people who self-harm do not present to hospital.[33,34] Of those that do present to hospital, only a small proportion are admitted to hospital — many being treated in emergency departments — thus highlighting the fact that the individuals contained in this dataset are likely representative of the most acute self-harming events.

Many factors are considered to contribute to the stress and mental ill health of workers' compensation claimants. In Canada, Lippel identified that stigma, a lack of social support,[6] as well as a clear power imbalance between workers and the organisations that administer compensation schemes, were associated with poor mental health outcomes.[6] A survey of injured Australian workers found that a high proportion were experiencing financial stress,[35] a known predictor of mental health conditions. Further, a qualitative study in Australia reported that many workers' compensation claimants found the procedural processes and language used antagonistic, information difficult to access, and the claims process to be adversarial.[11] They also reported poor and disrespectful communication of information and erratic payment of benefits as contributing to stress.[11] For many, there was a sense of being stigmatised for being on workers' compensation, with pervasive stereotypes that portray claimants as malingerers and abusing the system, causing stress and having damaging effects on claimants' psychosocial wellbeing.[11]

The reasons for the slightly discrepant findings between the different classifications of self-harm are not clear, but may be related to mis-classification of some self-harming behaviours, as has been documented elsewhere.[17–19] Low sensitivity of ICD-10 codes has been observed in the diagnoses of suicidal and self-harming presentations to hospitals,[20] and it is therefore possible that the differences between associations obtained using the different self-harm classifications is reflective of the sub-optimal sensitivity of diagnostic codes. This has been noted in other research, with calls for a more standardised approach to diagnostic coding to improve identification of suicide and self-harm.[20] It is also possible that the discrepancy is related to low numbers. For

all results in this paper, the wide confidence intervals for the workers' compensation estimates indicate uncertainty in the estimates and are likely related to the comparatively small numbers in the workers' compensation group. The intentional self-harm category represents a further sub-category within the broader group of hospital admissions, and when considered in relation to workers' compensation, there is even greater uncertainty.

It is unclear why the results indicated consistently elevated rates of hospital admissions for females for both self-harm measures, but only intentional self-harm/self-poisoning/undetermined intent for males. Females self-harm at higher rates than males.[36,37] and there is also some international evidence that gender discriminatory processes and biases mean that workers' compensation has been more difficult for females to access (compared to males).[38] It is not known whether such discriminatory practices exist in Australia and are therefore driving these associations, however this highlights another important avenue for future research.

One important consideration is that being a compensation claimant could have different and unknown effects on the claimants' health care access and utilisation. Some claimants may have "ready access" to health care paid for through the workers' compensation claim. Where the original claim is for a psychological injury, or where the psychological components of an injury have been accepted as part of the claim, such care would include psychological care. The effect of such health care access could mean that a claimant receives suitable and appropriate care through their claim, and mean that they are less likely to present to hospital. Conversely, it is possible that unsuccessfully seeking recognition and treatment for a psychological injury, or the psychological consequences of a physical injury leaves symptoms untreated and exacerbated. This highlights a need for more comprehensive data that enables the identification of factors such as the type of workplace injury, as well as the specification of the temporal ordering between events including the workplace injury, psychological distress, self-harming event, compensation claim and hospital admission.

Importantly too, suicide in Australia is compensable if a link between the workplace injury and the suicide can be demonstrated.[39,40] Workers' compensation may be denied however, when the link between employment and injury is broken, as statutes preclude the payment of compensation in the event of self-inflicted injury.[40] Accordingly, self-harm or suicide may mean the cessation (or non-recovery) of benefit payments. If, however, the link between injury and self-harming event/suicide is mediated by the compensation process, and it is in fact the compensation process and not the injury that leads to self-harm, then there are important implications for compensation schemes. Specifically, if it is the process, rather than the injury that is the risk factor for self-harming behaviours, then this would align multiple interests: most importantly, those of workers who deserve safe and just compensation; as well as compensation schemes and government, who are interested in minimising the cost of workplace injuries. Addressing stressors in the compensation process to reduce self-harming injuries and suicides among compensation claimants is in the interests of all parties. Irrespective of whether the increased admissions for self-harm are related to the compensation process or the injury itself, workers' compensation schemes should strive to reduce the stress of pursuing compensation for a workplace injury. This should include working to reduce stigma associated with workers' compensation, and attempting to ensure that claimants engagement with compensation organisations are not hostile or adversarial. While this work adds to the body of evidence suggesting that workers' compensation may have a deleterious effect on self-harming behaviours, there is a clear need for further research to clarify the causal pathways underpinning this association.

Strengths and limitations

We note some important limitations of this analysis. These issues principally pertain to the use of an administrative dataset that has not been designed for research purposes. While information on key variables such as age and gender were available, we had no information on other important risk factors that would vary by the two populations such as income, occupation, indigenous status or education. Furthermore, we were unable to identify employed persons in the VAED dataset. This means that the non-compensable numerator and denominator were drawn from the general population, rather than the employed population, thereby reducing the comparability of our two populations, and potentially leading to selection bias due to the healthy worker effect. We note however, that such selection bias related to the healthy worker effect would likely lead to an under-estimation of the true difference between the two groups. Relatedly, the comparator group included non-compensable individuals as well as those compensable under other schemes (although upon investigation we found that this only included claimants compensable under the transport accident scheme, and none were in veterans' compensation schemes). While ideally analysis would remove those compensable under the transport accident scheme or separate them from the two other categories, this classification was necessary as we had no information to use as the denominator for those in the transport accident scheme. Such classification may have reduced our ability to detect differences between groups. Another limitation was that we had no measure of baseline mental health, and therefore cannot exclude the possibility that the associations observed here are related to prior mental health. Misclassification

of claimant status is also possible, as we had no information on the length of time between the acquisition of the workplace injury, submission of a claim for workers' compensation, or admission to hospital. It is therefore possible that some patients had submitted a claim for workers' compensation but had not yet been awarded compensation. Relatedly, we have no information on the completeness or reliability of compensation status in hospital records. Compensation may be more likely to be recorded when presentation to hospital is for injuries directly related to a compensation claim, and perhaps less likely for claims related to psychological injury, or for psychological sequalae of an ongoing physical injury. It is therefore possible that there was misclassification of compensation status among some workers' compensation claimants. Such misclassification would likely bias estimates toward the null. As a final point, we had no information on workers' compensation status prior to admission, so it is possible that some patients had previously been workers' compensation claimants and were hospitalised after the cessation of their compensation payments.

While not necessarily a limitation, we note that most self-harm events do not results in hospital admission, and so the records contained here represent the most acute or recognised/recorded self-harming behaviours.

In terms of strengths, we assessed a broader set of behaviours than are otherwise typically considered in relation to self-harm. This enabled us to capture injuries and admissions that may have been misclassified (and not categorised as self-harming).

Conclusions

In conclusion, the findings reported here indicate that female claimants of workers' compensation, but not males, have elevated rates of hospital admission for intentional self-harming events. Analysis using a broader set of ICD-10 codes capturing intentional 'self-harm and probable self-harm' indicate that both male and female workers' compensation claimants have increased rates of admission to hospital. Further research is needed to ascertain the causal factors that underpin these heightened rates of hospitalisation for self-harm among workers' compensation claimants.

Contributors

All authors contributed to project conception. TLK and KS acquired the data. KS carried out analysis. TLK wrote the manuscript. All authors contributed to interpretation of results and drafting of the manuscript. All authors approved the final version of the manuscript.

Data sharing statement

The data that support the findings of this study are not publicly available due to the conditions of data access from the data custodians (the Centre for Victorian Data Linkage). Interested individuals can apply to CVDL, and once approved, can apply to the corresponding author, [TLK].

Declaration of interests

The authors declare no competing interests.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.lanwpc.2022.100614.

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