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Assault predicts time away from work after claims for work-related mild traumatic brain injury

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ABSTRACT

Introduction Workplace violence carries a substantial economic loss burden. Up to 10% of all traumatic brain injury (TBI) admissions result from physical assault. There remains a paucity of research on assault as a mechanism of injury, taking into account sex, and its association with work re-entry.

Objectives The aim of this study was to characterise, by sex, the sample of workers who had sustained a work-related mild TBI (wr-mTBI) and to assess the independent influence of assault, as a mechanism of injury, on time away from work.

Methods A population-based retrospective cohort of workers' compensation claimants in Australia (n=3129) who had sustained a wr-mTBI was used for this study. A multivariable logistic regression analysis assessed whether workers who had sustained wr-mTBI as a result of assault (wr-mTBI-assault) were more likely to claim time off work compared with workers who had sustained a wr-mTBI due to other mechanisms.

Results Among claimants who sustained a wr-mTBI, 9% were as a result of assault. The distribution of demographic and vocational variables differed between the wr-mTBI-assault, and not due to assault, both in the full sample, and separately for men and women. After controlling for potential confounding factors, workers who sustained wr-mTBI-assault, compared with other mechanisms, were more likely to take days off work (OR 2.14, 95% CI 1.53 to 2.99) within a 3-month timeframe.

Conclusion The results have policy-related implications. Sex-specific and workplace-specific prevention strategies need to be considered and provisions to support return-to-work and well-being within this vulnerable cohort should be examined.

Key messages

What is already known about this subject?
- Assault at the workplace is a public health concern, especially given the striking economical costs and associated psychological distress.
- It is not known whether assault is independently associated with time away from work following a 'mild' traumatic brain injury.

What are the new findings?
- Among a population of workers' compensation claimants with work-related mild traumatic brain injuries, the distribution of assaults are concentrated in certain occupations and industries—and vary by sex.
- Assault, as a mechanism of injury, independently predicts time away from work after a work-related mild traumatic brain injury.
- We did not observe any sex-specific differences in the association between assault and time of work.

How might this impact on policy or clinical practice in the foreseeable future?
- Return to work after work-related mild traumatic brain injury can be a challenging and often long-term process requiring ongoing support.
- Clinicians and other occupational health and safety stakeholders should continue to identify demographic and workplace risk factors that may influence this delayed re-entry into the workforce and recognise the need for tailored approaches to promote a better vocational outcome among a work-related mild traumatic brain injured population.

INTRODUCTION

Traumatic brain injury (TBI) is a major public health concern globally.[1–3] By 2020, TBI is estimated to be the third leading cause of global disease burden.[4] The incidence of TBI occurs mostly during the economically productive age-ranges, in terms of both workforce participation and average earning. Falls and motor vehicle collisions are considered the most common cause of TBI,[5] however, an estimated 8%–14% of all TBI admissions are a result of physical assault.[6 7] It is estimated that 75% of all TBIs are concussions or mild TBIs (mTBIs)[8]; mTBIs can lead to persistent physical, cognitive and psychosocial consequences.[9]

Work-related TBI (wr-TBI) is considered one of the most serious types of workplace injuries[10 11] and is associated with extensive costs including postinjury care, rehabilitation as well as disability-related lost wages and productivity. It is estimated that 71% of all workplace violent incidents are due to physical assaults.[12] In a review of wr-TBI literature, it has been estimated that assault accounts for 2%–5% of all wr-TBI cases,[13 14] nevertheless, assault in the workplace is estimated to be under-reported by 20%–40%, due a variety of reasons including stigma and perceived weakness.[15 16] The limited studies published to date, reveal that wr-TBI is associated with a significantly different profile of risk factors, demographic-related and injury-related, when compared with non-wr-TBI.[10] While male workers constitute greater proportion of wr-TBI,

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when examining the sex-specific rates for wr-TBI, injury severity appears to play a role as incidence rates have been reported to be similar for males and females with milder injuries.[17] When considering the age by sex interactions, it has been reported that higher proportions of wr-TBI were sustained by younger males and older females.[18] Additionally, certain employment characteristics (having a temporary job, being a full-time worker, working in certain occupations) are considered more insecure and may involve higher exposure to work hazards, prolonged recovery or extended time away from work.[19–24] Furthermore, lower socioeconomic levels and rural disparities have long been associated with a higher risk burden for diseases, injuries and death.[25 26] A gendered effect of wr-TBI is reported across industry sectors,[27] however, to date, the epidemiology of work-related mild TBI (wr-mTBI) is not well understood and it remains unclear if, in addition to personal, occupational and environmental characteristics, assault as a mechanism of injury may contribute to time away from work. This knowledge is especially critical given that TBI, sustained from physical assault, has previously been shown to be a potential independent predictor of poor rehabilitation outcome and community re-integration into normal life.[28 29] Nevertheless, wr-TBI studies to date have generally combined findings across severity levels, hence it is unknown what, if any, is the influence of milder injuries. The exploration within the context of wr-mTBI remains an evidence gap both with respect to the sex-based characterisation of the demographic and workplace factors and the understanding regarding impact on work re-entry. The objective of this population-based retrospective analysis was twofold:

1. To characterise, by sex, the sample of workers who had sustained a work-related mild TBI (wr-mTBI).
2. To assess the independent influence of assault, as a mechanism of injury, on time away from work.

METHODS

Study design and sample size

This study used administrative claims data from the Compensation Research Database (CRD) through the Institute for Safety, Compensation and Recovery Research at Monash University. The CRD comprises five administrative datasets from all workers' compensation claimants with WorkSafe Victoria in Australia. WorkSafe Victoria provides compensation insurance and rehabilitation to the majority of non-federal government employers, that is, an estimated 85%–90% of workers in Victoria.[26]

Two CRD datasets were used. The 'claims' dataset consisted of workers (n=5164) who lodged a compensation claim after sustaining a wr-TBI (2004–2012). Once liability is accepted, the employer is responsible for paying income replacement benefits for the first 10 days off work,[26] except when a buyout option is purchased (estimated 5% of claims).

TBI severity affects time off work,[28] and since there was no direct measure of injury severity (ie, Glasgow Coma Scale (GCS), loss of consciousness, etc) in the dataset, severity was determined using hospital admissions. The 'admissions' dataset (n=2869) was used to assess, hospitalisation occurrence postinjury and served as an indicator of injury severity.

Main predictor variables

A wr-TBI was identified when the variable 'affliction nature group' was coded as 'intracranial injuries' based on the Type of Occurrence Classification System[29]; aligned with the International Classification of Diseases-Australian Modification. The majority of the sample (98.6%) was coded as 'acquired brain injury—mild' or 'concussion and other intracranial injury'.

Within the wr-mTBI group, the subpopulation of interest was workers who had sustained wr-mTBI-assault. Assault was determined when the variable 'accident type' was coded as 'being assaulted by a person or persons'.

Others predictor variables

Injury severity—workers hospitalised within the first 90 days postinjury were considered more severe compared with those without a hospitalisation record.

Demographic—'sex' was defined as male or female. 'Age' was coded with increments each decade, that is, starting at 15 years. Socioeconomic status was coded into 10 deciles ranging from 1 (disadvantaged) to 10 (advantaged) based on the Index of Relative Socio-Economic Advantage and Disadvantage derived from 21 census variables such as education, income, etc.[30]

Vocational—'employment type' was categorised as full-time (working ≥35 hours/week), part-time (<35 hours/week) and others (eg, apprentice, work placement student, group trainee, volunteer, etc). 'Occupation group' and 'workplace industry' groups were based on the Australian and New Zealand Standard Classification of Occupations and the Australian and New Zealand Standard Industrial Classification, respectively.[31 32] For the purposes of this analysis (considering small cell sizes), 'occupation group' and 'workplace industry' were further collapsed from 8 occupation and 19 workplace categories into four categories each. Occupational group were defined as professionals, community and personal service workers, service-related occupations (managers, technicians and trades workers, clerical and administrative workers, sales workers, etc) and goods-related occupations (machinery operators, drivers and labourers). Workplace industries were categorised as 'public administration and safety', 'healthcare and social assistance', 'education and training' and 'others'. Lastly, 'employer size' was sorted in four groups based on payroll size: small (<$A1 million), medium ($A1–$A20 million), large (>$A20 million) and government organisations.

Dependent variable

The primary outcome of interest was time away from work postinjury, which given the scheme design in Victoria equates to >2 weeks off work due to the injury. Workers who took time off work within the first 90 days postaffliction were compared with those who did not take time off work. Days taken off for subsequent claims by the same claimant were not included to avoid duplication.

Data analysis

We used SPSS (V.24.0) to analyse the data. Injury-specific and sex-specific descriptive statistics were computed. A X^2 test of independence was performed to examine the relationship between assault and non-assault across the entire sample and then with sex-stratification. A multiple-comparison post hoc correction of $\alpha=0.002$ was used to establish a significance cut-off to counter the probability of a significant result due to mass univariate testing.[33] A multivariable logistic regression model was used to test the influence of wr-mTBI-assault on time away from work postinjury. All independent variables that showed an association with days off work ($p\leq0.05$) in the univariate analysis were included as covariates in the model (hospitalisation, sex, age, employer size, occupation type and workplace industry). As multicollinearity was detected among occupation type and

workplace industry, only the former was included in the models. Both employment type and socioeconomic status were also included as covariates in the model given their influence on prevalence of injury, prolonged recovery, impact on overall health outcomes as well as service utilisation.[16 21 22 34–38] Subsequently, sex-specific models were used to test the unique variables that predict days off work in males and females separately. A post hoc analysis was undertaken to determine if estimates for men and women differed.[39 40]

RESULTS

Study sample characteristics

The study sample consisted of 3129 wr-mTBI workers' compensation claims with 58.0% being from males. Assault, as a mechanism of injury, contributed to 8.8% of the wr-mTBI claims. Other mechanisms included being hit by moving objects (32.1%), falls, trips and slips of a person (26.1%), hitting objects with a part of the body (24.9%) and motor vehicle accidents and other (8.1%). The sample was characterised by sex and wr-mTBI-assault (table 1; table 2) to understand the relative distributions across various personal and vocational variables.

Age

The mean age of the sample neared 40 years across the assault and non-assault groups; similar distributions were observed among males and among females in each group.

Employment type and employer size

The assault group has a higher distribution of workers in the part-time and other employment types when compared with the non-assault group. Male wr-mTBI-assault workers had a significantly higher distribution of workers in the part-time group ($\chi 2$ (2, n=1814)=18.23, p<0.001) when compared with counterparts; no differences were observed among female subgroups. The wr-mTBI-assault group had a higher distribution of workers with large-sized and government employers (54%) when compared with the non-assault counterparts ($\chi 2$ (3, n=3129)=46.82, p<0.001). Among males, the wr-mTBI-assault group had a higher distribution of workers with small-sized and large-sized employers (58%) while among females wr-mTBI-assault group had the higher distribution (40%) of workers in the large-sized employers. The differences in distribution for males and for females across the assault groups were significant ($\chi 2$ (3, n=1814)=36.66, p<0.001; $\chi 2$ (3, n=1315)=24.36, p<0.001).

Occupation type and workplace industry

The distribution of occupations differed for the wr-mTBI-assault group compared with the non-assault group, with a greater proportion of professionals and community and personal service occupations (69%) in the assault group ($\chi 2$ (3, n=3129)=222.49, p<0.001). This pattern of higher proportions of professional and community and personal service occupations in the assault group compared with the non-assault group was replicated in the female sample while males had a higher proportion (73%) of services-related and community and personal service occupations ($\chi 2$ (3, n=1814)=242.33, p<0.001). The industrial composition of assault and non-assault samples with wr-mTBI were generally similar to those observed for occupations ($\chi 2$ (3, n=3129)=270.04, p<0.001), with a greater proportion of wr-mTBI due to assault in the industries of healthcare and public administration and safety, in the whole sample as well as for males ($\chi 2$ (3, n=1814)=245.86, p<0.001); for females, the proportion of wr-mTBI due to assault was higher in healthcare and education ($\chi 2$ (3, n=1315)=83.70, p<0.001).

There were no significant differences observed in the distributions of socioeconomic status, days off work or hospitalisation between assault and non-assault groups, in the whole sample or for men and women.

Table 1 Demographic characteristics of all workers who sustained wr-mTBI compared with the percentage that sustained assault-induced work-related mild traumatic brain injury (wr-mTBI)

	All workers who sustained wr-mTBI (3129)		% of sample with wr-mTBI-assault
All			8.79
Female	1315	42.00	8.52
Male	1814	58.00	8.99
Age at the time of injury (by decade)			
15–24 years	470	15.00	8.51
25–34 years	783	25.00	8.43
35–44 years	673	21.50	8.47
45–54 years	726	23.20	8.95
>55 years	477	15.20	9.85
Employment type			
Full-time employee	2146	68.60	7.88
Part-time employee	422	13.50	11.61
Others	561	17.90	10.16
Occupation type			
Community and personal service workers	480	15.30	24.79
Professionals	580	18.50	12.24
Services-related occupations (managers/technicians and trades workers/clerical and administrative workers/sales workers)	978	31.30	5.42
Goods-related occupations (machinery operators and drivers/labourers)	1091	34.90	2.93
Workplace industry group			
Healthcare and social assistance	343	11.00	20.41
Education and training	500	16.00	10.20
Public administration and safety	203	6.50	33.50
Others	2083	66.70	4.13
Employer size			
Small	641	20.50	8.42
Medium	1242	39.70	5.80
Large	794	25.40	9.45
Government	452	14.40	16.37
Socioeconomic status			
1–2 (most disadvantaged)	493	15.80	8.92
3–4 (disadvantaged)	468	15.00	8.33
5–6 (middle)	717	22.90	7.81
7–8 (advantaged)	750	24.00	9.33
9–10 (most advantaged)	701	22.40	9.42
Days off work			
Did not take days off work	2554	81.60	8.14
Took days off work	575	18.40	11.65
Hospitalised			
Not hospitalised	2647	84.60	9.07
Hospitalised	482	15.40	7.26

Independent impact of assault on time away from work

A total of 575 workers (18.4%) took time off work (within a 3-month time frame) after their wr-mTBI. Males constituted

Table 2 Sex-stratified demographic characteristics of all workers who sustained wr-mTBI due to assault and non-assault mechanisms

	Non-assault-induced wr-mTBI (2854)		Assault-induced wr-mTBI (275)		Males (1814)				Females (1315)			
					Non-assault		Assault		Non-assault		Assault	
	n	%	n	%	n	%	n	%	n	%	n	%
Female	1203	42.2	112	40.7								
Male	1651	57.8	163	59.3								
Age at the time of injury (by decade)												
15–24 years	430	15.1	40	14.5	238	14.4	26	16	192	16	14	12.5
25–34 years	717	25.1	66	24	416	25.2	47	28.8	301	25	19	17
35–44 years	616	21.6	57	20.7	401	24.3	35	21.5	215	17.9	22	19.6
45–54 years	661	23.2	65	23.6	335	20.3	30	18.4	326	27.1	35	31.3
>55 years	430	15.1	47	17.1	261	15.8	25	15.3	169	14	22	19.6
Employment type *												
Full-time employee	1977	69.3	169	61.5	1273	77.1	105	64.4	704	58.5	64	57.1
Part-time employee	373	13.1	49	17.8	81	4.9	19	11.7	292	24.3	30	26.8
Others	504	17.7	57	20.7	297	18	39	23.9	207	17.2	18	16.1
Occupation type † * ‡												
Community and personal service workers	361	12.6	119	43.3	124	7.5	75	46	237	19.7	44	39.3
Professionals	509	17.8	71	25.8	133	8.1	19	11.7	376	31.3	52	46.4
Services-related occupations (managers/technicians and trades workers/ clerical and administrative workers/sales workers)	925	32.4	53	19.3	586	35.5	44	27	339	28.2	9	8
Goods-related occupations (machinery operators and drivers/labourers)	1059	37.1	32	11.6	808	48.9	25	15.3	251	20.9	7	6.3
Workplace industry group † * ‡												
Healthcare and social assistance	273	9.6	70	25.5	42	2.5	15	9.2	231	19.2	55	49.1
Education and training	449	15.7	51	18.5	121	7.3	11	6.7	328	27.3	40	35.7
Public administration and safety	135	4.7	68	24.7	79	4.8	60	36.8	56	4.7	8	7.1
Others	1997	70	86	31.2	1409	85.4	77	47.2	588	48.8	9	8.1
Employer size † * ‡												
Small	587	20.6	54	19.6	421	25.5	49	30.1	166	13.8	38§	34.00§
Medium	1170	41.00	72	26.2	727	44	39	23.9	443	36.8		
Large	719	25.2	75	27.3	382	23.1	46	28.2	337	28	29	25.9
Government	378	13.2	74	26.9	121	7.3	29	17.8	257	21.4	45	40.2
Socioeconomic status												
1–2 (most disadvantaged)	449	15.7	44	16	297	18	30	18.4	152	12.6	14	12.5
3–4 (disadvantaged)	429	15	39	14.2	262	15.9	24	14.7	167	13.9	15	13.4
5–6 (middle)	661	23.2	56	20.4	417	25.3	34	20.9	244	20.3	22	19.6
7–8 (advantaged)	680	23.8	70	25.5	389	23.6	37	22.7	291	24.2	33	29.5
9–10 (most advantaged)	635	22.2	66	24	286	17.3	38	23.3	349	29	28	25
Days off work												
Did not take days off work	2346	82.2	208	75.6	1318	79.8	115	70.6	1028	85.5	93	83
Took days off work	508	17.8	67	24.4	333	20.2	48	29.4	175	14.5	19	17
Hospitalised												
Not hospitalised	2407	84.3	240	87.3	1319	79.9	136	83.4	1088	90.4	104	92.9
Hospitalised	447	15.7	35	12.7	332	20.1	27	16.6	115	9.6	8	7.1

*X^2 test significant at p<0.000 (assault vs non-assault; males).
†X^2 test significant at p<0.000 (assault vs non-assault).
‡X^2 test significant at p<0.000 (assault vs non-assault; females).
§Categories collapsed due to small cell count.
wr-mTBI, work-related mild traumatic brain injury.

the majority (66.3%) of these workers and 8.3% of these males sustained wr-mTBI-assault.

A multivariable logistic regression analysis was performed to predict whether additional time off work was taken by workers who had sustained wr-mTBI-assault compared with the non-assault group (table 3). To evaluate the independent impact of assault on time away from work, a total of three multivariable logistic regression models were adjusted using a forward selection approach to improve the model to a statistically significant extent. For model 1, in addition to assault and hospitalisations, all covariates related to the workers' personal characteristics (sex and age) were added to this model. In the second model, employment-related variables (employment status, employer size and occupation type and workplace industry) were included. Model 3 was adjusted for all covariates including socioeconomic status to understand the impact of assault on time away from

Table 3 Multivariable regression models showing the odds of taking days away from work as a result of wr-mTBI-assault, with adjustments for injury severity, demographic, workplace and social factors (n=3129)

	Model 1*		Model 2†		Model 3‡	
Parameter	OR estimates	95% Wald confidence limits	OR estimates	95% Wald confidence limits	OR estimates	95% Wald confidence limits
Mechanism of injury						
wr-mTBI (non-assault)	1.00	–	1.00	–	1.00	–
Assault-induced wr-mTBI	**1.72**	**1.26 to 2.36**	**2.12**	**1.52 to 2.96**	**2.14**	**1.53 to 2.99**
Injury severity (hospitalisation)						
Not hospitalised	1.00	–	1.00	–	1.00	–
Hospitalised	**7.73**	**6.20 to 9.63**	**6.94**	**5.54 to 8.70**	**6.98**	**5.57 to 8.75**
Sex						
Male	0.83	0.68 to 1.03	1.06	0.84 to 1.34	1.05	0.83 to 1.33
Age at the time of injury (by decade)						
15–24 years	1.00	–	1.00	–	1.00	–
25–34 years	**0.57**	**0.40 to 0.83**	**0.54**	**0.37 to 0.78**	**0.54**	**0.37 to 0.78**
35–44 years	**0.53**	**0.36 to 0.76**	**0.48**	**0.33 to 0.70**	**0.48**	**0.33 to 0.70**
45–54 years	**0.39**	**0.27 to 0.56**	**0.36**	**0.25 to 0.51**	**0.36**	**0.25 to 0.51**
55+ years	**0.36**	**0.25 to 0.53**	**0.34**	**0.23 to 0.50**	**0.34**	**0.23 to 0.51**
Employment type						
Full-time employee	1.00	–	1.00	–	1.00	–
Part-time employee	–	–	1.09	0.79 to 1.51	1.08	0.78 to 1.50
Other employees	–	–	0.96	0.74 to 1.26	0.96	0.73 to 1.25
Employer size						
Large	1.00	–	1.00	–	1.00	–
Medium	–	–	**0.72**	**0.56 to 0.93**	**0.72**	**0.56 to 0.92**
Small	–	–	**0.43**	**0.32 to 0.56**	**0.42**	**0.32 to 0.56**
Occupation type						
Community and personal service occupations	1.00	–	1.00	–	1.00	–
Service-oriented occupations	–	–	**0.66**	**0.47 to 0.95**	**0.66**	**0.46 to 0.95**
Professionals	–	–	0.83	0.56 to 1.23	0.84	0.57 to 1.24
Goods-oriented occupations	–	–	**0.68**	**0.48 to 0.98**	**0.67**	**0.46 to 0.96**
Socioeconomic status						
9–10 (advantaged)	1.00	–	1.00	–	1.00	–
7–8 (advantaged)	–	–	–	–	1.06	0.79 to 1.43
5–6 (middle)	–	–	–	–	1.00	0.75 to 1.34
3–4 (disadvantaged)	–	–	–	–	1.28	0.91 to 1.80
1–2 (most disadvantaged)	–	–	–	–	1.21	0.86 to 1.70

Categories mechanism of injury, injury severity, age at the time of injury and employer size (small) were significant at p<0.000; categories employer size (medium) and occupation type were significant at p=0.01 and p=0.02 respectively.
*Model adjusted for personal demographic factors (sex and age as per above).
†Model re-adjusted to include workplace factors (employment type, employer size and occupation type as per above).
‡Model re-adjusted to include social factors (socioeconomic status as per above).
wr-mTBI, work-related mild traumatic brain injury.

work. After controlling for all possible covariates, within model 3, workers who sustained their injury as the result of an assault were twice more likely to have taken days off work (OR 2.14, 95% CI 1.53 to 2.99) compared with those who had not been assaulted (table 3). While we had non-significant covariates in the models, we chose not to be selective eliminating of covariates in a backward stepwise elimination given their significant association with days off work and more importantly the theoretical underpinning that led us to identify them as potential covariates in the first place.

A sex-stratified analysis of this multivariable model was conducted (table 4). In the males-only model, workers who sustained assault were twice more likely to take days off work (OR 2.17, 95% CI 1.39 to 3.36). The relationship between assault and time off work in the females-only model was not statistically significant (OR 1.74, 95% CI 0.99 to 3.05), but in the same direction. Both sex-stratified models were adjusted for injury severity and potential covariates. Post hoc comparison of estimates, taking into account the OR and the confidence band for assault for the male model and female model, indicated that the estimates for assault and time off work among men and among women, were not statistically different from each other.[39 40]

DISCUSSION

In this census of Victorian workers' compensation claimants who sustained a wr-mTBI, 8.8% of the injuries were due to assault. The overall proportion of mTBIs that resulted from assaults is consistent with the literature, that is, 6.6%–10%.[7 10 25 41] It is worth noting that our sample is distinct from previous studies as it constitutes exclusively of workers who had sustained a work-related injury and a mild injury severity.

Table 4 Sex-stratified analysis of multivariable models

	Model (males) (N=1814)		Model (females) (N=1315)	
Parameter	**OR**	**95% Wald confidence limits**	**OR**	**95% Wald confidence limits**
Mechanism of injury				
wr-mTBI (non-assault)	1.00	–	1.00	–
Assault-induced wr-mTBI	**2.17**	**1.40 to 3.36**	1.74	0.99 to 3.05
Injury severity (hospitalisation)				
Not hospitalised	1.00	-	1.00	–
Hospitalised	**7.24**	**5.52 to 9.51**	**6.29**	**4.13 to 9.59**
Age at the time of injury (by decade)				
15–24 years	1.00	–	1.00	–
25–34 years	**0.59**	**0.37 to 0.94**	**0.46**	**0.24 to 0.88**
35–44 years	0.63	0.39 to 1.01	**0.28**	**0.15 to 0.54**
45–54 years	**0.39**	**0.25 to 0.62**	**0.29**	**0.16 to 0.54**
55+ years	**0.38**	**0.23 to 0.61**	**0.29**	**0.15 to 0.56**
Employment type				
Full-time employee	1.00	–	1.00	––
Part-time employee	1.06	0.59 to 1.90	1.14	0.77 to 1.70
Other employees	0.85	0.61 to 1.18	1.30	0.80 to 2.10
Employer size				
Large	1.00	–	1.00	–
Medium	0.78	0.56 to 1.10	**0.62**	**0.42 to 0.90**
Small	**0.40**	**0.28 to 0.57**	**0.49**	**0.29 to 0.80**
Occupation type				
Community and personal service occupations	1.00	–	1.00	–
Service-oriented occupations	0.95	0.58 to 1.55	**0.43**	**0.25 to 0.74**
Professionals	1.06	0.56 to 2.00	0.63	0.37 to 1.08
Goods-oriented occupations	0.90	0.55 to 1.47	**0.45**	**0.26 to 0.80**
Socioeconomic status				
9–10 (advantaged)	1.00	–	1.00	–
7–8 (advantaged)	1.19	0.81 to 1.76	0.94	0.60 to 1.49
5–6 (middle)	1.17	0.80 to 1.71	0.81	0.51 to 1.30
3–4 (disadvantaged)	**1.73**	**1.10 to 2.70**	0.79	0.47 to 1.33
1–2 (most disadvantaged)	1.37	0.90 to 2.10	1.03	0.57 to 1.85

For males: categories injury severity, age (45–54 and 55+) and employer size (small-sized) were significant at p<0.000; category mechanism of injury was significant at p=0.001; categories socioeconomic status and age (25–34 and 35–44) and were significant at p=0.01, p=0.02 and p=0.05 respectively. For females: categories injury severity and age (35–44, 45–54 and 55+) were significant at p<0.000; categories employer size (medium), socio-economic status (most disadvantaged), employment type and occupation type were significant at p=0.002, p=0.003, p=0.005 and p=0.006 respectively; categories age (25–34) and employer size (small) were significant at p=0.01; category mechanism of injury was significant at p=0.05.
wr-mTBI, work-related mild traumatic brain injury.

Using a multivariable analysis, this study provides the first evidence that assault was associated with a twofold increased probability of requiring time off work, compared with non-assault, even after adjustment for potential covariates. This suggests that assault events are independent factors associated with time off work in the wr-mTBI population. Our findings are consistent with previous studies that have shown that assault can negatively affect the expectations of outcome postinjury,[42] negative perceptions and beliefs can influence complaints after mTBI and interfere with vocational outcome,[43] psychological distress is a substantial contributor to work re-entry efforts compared with severity of brain injury[44] and injury intentionality negatively influences community integration.[24] We propose that workers who sustain wr-mTBI-assault (vs non-assault) are a distinct cohort, and may require specific workplace support to meet their unique and specific psychological needs.

In our sex-specific models, we observed that assault was associated with an increased risk of time off work among both men (OR 2.17, 95% CI 1.40 to 3.36) and women (OR 1.74, 95% CI 0.99 to 3.05), although this estimate was only statistically significant among men. Post hoc analyses confirmed that estimates for men and women for assault and time off work were not statistically different from each other. In other words, we did not see any sex-specific differences in the association of assault and time away from work. We caution that while these sex-specific estimates are not statistically significant, one cannot dismiss sex as a potential influencer of outcome for individuals who have sustained wr-mTBI-assault. It is likely that we were unable to capture sex-based real-life complexities and implications for outcomes in this retrospective analysis of secondary data.

Despite the lack of sex-specific differences in our modelling, we report that there are indeed sex-based differences in the characteristics of the population. In our sample, male workers who had sustained assault had a higher proportion of part-time and other (eg, apprentice, work placement student, group trainee, volunteer, etc) employees, worked in the community and personal service as well as service-related occupations, worked in the public administration and safety industry and worked with

large-sized and government employers. Among female workers who sustained assault, a higher proportion were of older age, worked as professionals, were in community and personal service occupations, worked in the healthcare and social assistance as well as education and training industries and worked with government employers.

Our earlier work shows that men with TBI, although across the injury severity spectrum, had a longer duration of time off work compared with women.[45] Interestingly, this particular finding is consistent across studies despite our sample being exclusively mTBI. Higher proportions for mTBI as well as assault have previously been reported in the education sector, particularly among females.[46] When interpreting the results, it is important to recognise that a higher distribution of assault across certain occupations (professionals), workplaces (healthcare) as well as employers (government) may be attributable to the mandate for a violence-free environment and hence may have better reporting policies when compared with other occupations and employers where an unacceptable incidence such as assault may be stigmatised and not reported. It is equally important to recognise that better reporting policies are only part of the solution. There are inherent differences in how males and females report assault across workplace industries. For instance, female psychiatric-ward nurses may under-report assault as it may be perceived as an 'expected' outcome of the job or because it bring into question competency,[47] while policemen/firefighters need to report an assault given the documentation requirements of their job and the global perception of 'heroism' after surviving an assault. There is a need to understanding these subtle sex-specific nuances that may drive work-related outcome and these should be addressed in future studies and during policy development efforts.

Strengths and limitations

The sample used by our study is the largest published on the topic to date. To the best of our knowledge, this is the first population-based study that has stratified the sample by sex to characterise the demographic and workplace factors associated with wr-mTBI-assault and controlled for injury severity to explore the influence of wr-mTBI-assault on days away from work.

There are some limitations to consider when interpreting the findings of this study. First, the dataset lacks information pertaining to injury severity (loss of consciousness, GCS, specific impairments, etc) other than hospitalisation which is a crude measure. Second, information regarding the circumstances leading to assault, the perpetrator that caused the assault and/or whether these factors were addressed prior to the work re-entry.[48] Third, small cell sizes necessitated collapsing categories for certain variables which may have constrained interpretations. Fourth, there was no information in the dataset regarding the workers' participation, or lack thereof, in a RTW programme, and/or workplace accommodations which could influence days off work. Fifth, there was no direct information regarding the psychological well-being of the worker as the complexity associated with distress, maladaptive coping behaviours, litigation and/or concurrent disorders can delay recovery.[49–52] Lastly, information pertinent to premorbid history, history of alcohol/drug abuse and/or concurrent diagnoses were not identified within the dataset. Nevertheless, these factors would have to be strongly related to both assault and time away from work to significantly attenuate the association we have reported between assault and time off work.

Our study builds on previous work in this population of injured workers showing differential injured worker and rehabilitation services use by sex.[53 54] Comprehensive individualised accounts may help shed light on currently unexplored processes by way of employing mixed methods and versatile data integration analytical approaches. Furthermore, consideration to sex and gender should explicitly be considered with this population.

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