Risk Factors for Developing Concurrent Posttraumatic Stress Injury After Work-Related Musculoskeletal Injury
A Case-Control Study

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Objective: This study aimed to study risk factors for developing concurrent posttraumatic stress injury (PTSI) among workers experiencing work-related musculoskeletal injury (MSI). Methods: A case-control study was conducted using workers’ compensation data on injured workers undergoing rehabilitation programs for concurrent MSI and PTSI (cases) and MSI only (controls). A variety of measures known at the time of the compensable injury were entered into logistic regression models. Results: Of the 1948 workers included, 215 had concurrent MSI and PTSI. Concurrent MSI and PTSI were predicted by type of accident (adjusted odds ratio [OR], 25.8), experiencing fracture or dislocation fracture or dislocation (adjusted OR, 3.7), being public safety personnel (adjusted OR, 3.1), and lower level of education (adjusted OR, 1.9). Conclusions: Experiencing a concurrent PTSI diagnosis with MSI after work-related accident and injury appears related to occupation, type of accident, and educational background.

Keywords: rehabilitation, posttraumatic stress disorder, public safety personnel, risk factors, compensation and redress

Workers experiencing traumatic musculoskeletal injury (MSI) are at risk of developing posttraumatic stress injury (PTSI).1 The prevalence of posttraumatic stress after acute orthopedic trauma varies from study to study, but a recent meta-analysis of patients with acute orthopedic injuries reported a weighted pooled prevalence of diagnosed posttraumatic stress disorder of 26% (95% confidence interval [CI], 19.0%-35.9%).2 Workers with concurrent MSI and PTSI are also more likely to experience delayed recovery, including being less likely to return to work.3 Knowing risk factors for development of PTSI after MSI could help clinicians, employers, insurers, and other stakeholders intervene to prevent development of PTSI after injury, thus improving the prospect of clinical and return to work outcomes.

Previous research examining PTSI after MSI has identified a variety of salient risk factors related to the nature of the accident and injury, as well as clinical factors related to the acute injury.1,4 A study of military personnel experiencing extremity long bone fracture found that lower extremity fracture, multiple fractures, and higher pain Visual Analog Scale (VAS) scores were associated with development of PTSI.5 Other studies have identified that acute pain severity and associated psychological symptoms, such as catastrophizing, fear avoidance, low self-efficacy, and emotional problems, are also associated with development of PTSI symptoms.6,10 These clinical characteristics are known to be influenced by physiological, social, and cultural factors.1,3

Posttraumatic stress injury symptoms and chronic pain from MSI share common psychological vulnerability factors, such as previous exposure to trauma or physical injury or preexisting mental health conditions, which increase the risk for complicated outcomes.1 Symptoms of pain and psychological trauma have been conceptualized as “mutually maintaining” at physiological, affective, and behavioral levels.12–14 This means that each PTSI and MSI can serve to maintain and exacerbate symptoms of the other. Without early identification of PTSI, individuals’ symptoms are likely to worsen, and the subsequent co-occurring MSI and PTSI will become even more difficult to treat and rehabilitate. For these reasons, early identification of workers at risk of developing PTSI after work-related MSI is critically important. Improved knowledge of risk factors for developing PTSI will enhance our ability to detect workers in need of early PTSI assessment, intervention, and rehabilitation services and to tailor treatments to individual needs.

Many Canadian Workers’ Compensation Boards (WCB) have implemented policies and care models to guide rehabilitation of workers with PTSI, which are accepted as compensable work-related injuries.15–18 The WCB-Alberta implemented a PTSI care model in 2002 that includes psychological screening, cognitive-behavioral and exposure therapies, medical and psychiatric management, interdisciplinary rehabilitation, and worksite reintegration.19 Accessing data consequent to this model, we studied injured workers undergoing rehabilitation in Alberta to identify risk factors for developing concurrent PTSI following work-related MSI.
METHODS

Design

A case-control study was conducted. Case-control research designs are observational studies that allow investigation of a phenomenon of interest, such as risk for developing PTSI, through comparing people with a condition (ie, cases) with those without the condition (ie, controls).24 Because they are observational, case-control studies have some limitations for establishing definitive causal links. However, they are an epidemiological approach that can be used in situations where it is not ethically or practically possible to expose individuals to a factor of interest (in this situation, traumatic events) during a randomized controlled trial.25 This research was approved by University of Alberta’s Health Research Ethics Board. A waiver of informed consent was obtained because this study used archived historical data, and it was deemed to be either impractical or impossible to contact all workers to obtain consent.

Study Sample

We obtained information collected on all injured workers admitted to WCB-Alberta PTSI rehabilitation programs from across the province (n = 807) between January 1, 2017, and August 31, 2019. Of the 807 workers undergoing PTSI rehabilitation, 215 (26.6%) were also diagnosed with MSI as identified via file review and International Classification of Diseases, Ninth Revision, diagnostic codes.26 These 215 workers with both PTSI and MSI formed our case group. A control group was formed from a randomly selected group of 1733 workers from the broader population of workers with MSI admitted to other WCB-Alberta occupational rehabilitation programs during the same time frame, who did not subsequently develop PTSI over the study period.

PTSI Rehabilitation Programs

At the time of data collection, the WCB-Alberta model for PTSI rehabilitation recommended that injured workers with functional limitations in work duties due to trauma- or stressor-related disorders, anxiety-related or mood disorders, or other psychiatric conditions undergo a PTSI screening assessment.19 A registered psychologist would interview the worker and administer relevant clinical tests to determine factors interfering with return to work that resulted from exposure to workplace trauma. If PTSI was suggested, workers were referred to varying levels of rehabilitation that have been described elsewhere.3

MSI Rehabilitation Programs

The WCB-Alberta rehabilitation programs for MSI also followed a continuum of care model.22 Workers who had not recovered within 6 to 8 weeks after MSI were referred for multidisciplinary rehabilitation. Workers with MSI who also experienced or developed functional limitations due to trauma- or stressor-related disorders, anxiety-related or mood disorders, or other psychiatric conditions underwent a PTSI screening assessment as described previously and were transferred to a PTSI rehabilitation program.

Measures

Independent Variables

The data set included a variety of descriptive variables including demographic factors (eg, age, sex, and educational level), occupational factors (eg, National Occupational Classification code, whether the worker was public safety personnel [police, firefighter, paramedic, emergency medical technician, or corrections officer], employment and working status, and receipt of time loss benefits), health/injury factors (eg, type of accident, part of body injured, duration of injury, diagnosis, and number of previous claims), and self-ratings of pain intensity (100-point VAS), pain-related disability (Pain Disability Index),23 and Health-Related Quality of Life (36-item Short-Form Health Survey [SF-36] domain scores).4,25

Outcome (Dependent) Variable

The outcome variable for this study was whether workers experienced concurrent MSI and PTSI (cases) or MSI only (controls) as determined by the rehabilitation program undertaken and confirmed by International Classification of Diseases, Ninth Revision, diagnostic codes and file review.

Data Analysis

We computed descriptive statistics for the workers in the data set, comparing workers undergoing PTSI rehabilitation (with and without MSI) with those undergoing rehabilitation programs for MSI only. We compared descriptive statistics of the 215 workers with concurrent MSI and PTSI with the 592 workers with PTSI only and 1733 workers with MSI only using appropriate statistics, including t tests and the χ² test. For our main objective, we used multivariable logistic regression26 to identify significant risk factors for concurrent MSI and PTSI. We used a purposeful modeling strategy.26 First, we used univariate logistic regression to examine each potential risk factor. The independent variables that were significant at P value of <0.10 were then entered into multivariable logistic regression models, and the variables that were not statistically significant at P value of <0.05 were removed. Next, the confounding effects of the removed variables on the retained variables were examined by observing for changes in regression coefficients of >20%. Relevant assumptions (eg, normality and collinearity) were tested.27 The final models include all statistically significant variables at P value of <0.05. All analyses were done using IBM SPSS version 28 (Chicago, IL).

RESULTS

Characteristics of Workers Undergoing Rehabilitation

The case group was formed from the 215 workers undergoing rehabilitation for PTSI who had concurrent MSI (characteristics compared with those with PTSI only are shown in Table 1). The control group included 1733 workers with MSI only. Workers with concurrent MSI and PTSI were more likely to have been injured at the workplace (70.9% vs 45.0%, P < 0.001), and there were more concurrent diagnoses of a condition (69.7% vs 47.1%, P = 0.001), and diagnosis of a psychological/behavioral disorder (74.6% vs 49.6%, P < 0.001). Workers with concurrent MSI and PTSI were markedly less likely to work in trades (39.9% vs 32.3%, P = 0.018) or transport accidents (34.4% vs 60.0%, P = 0.001) rather than overexertion (3.3% vs 60.0%, P < 0.001). Workers with concurrent MSI and PTSI were markedly less likely to return to work after rehabilitation (32.1% vs 4.0% not fit to return to preaccident levels of work at discharge, P < 0.001).

Patient-Reported Measures

Scores on patient-reported measures are reported in Table 2. Compared with those with MSI only, those with concurrent MSI and PTSI reported lower levels of pain intensity (46.6 vs 55.6 of 100, P < 0.001) and disability (42.0 vs 53.7 of 100 on the Pain Disability Index, P < 0.001). However, there were substantial missing data on the patient-reported measures, with 1243 workers (48.9%) not completing at least one of the VAS or PDI measures. Workers with missing data on the patient-reported measures were significantly more likely to have concurrent MSI and PTSI (77.2% vs 30.5%, P < 0.001), more likely to work in trades (39.9% vs 32.3%, P < 0.001), and less likely to be diagnosed with sprain/strain injury rather than fracture (28.3% vs 45.0%, P < 0.001). Because of the large amount of missing patient-reported data, separate multivariable analyses were conducted with and without the patient-reported measures.

Risk Factors for Developing Concurrent PTSI After MSI

Univariate, unadjusted odds ratios (OR) and 95% CI for developing PTSI in workers with MSI are shown in Table 3. Because of small numbers in some categories, some categorical variables were collapsed for logistic regression modeling. These variables included...
A wide variety of occupational and injury-related factors were significantly associated with this outcome. Workers were at higher odds of developing PTSI if they were public safety personnel (OR, 5.05; 95% CI, 2.72–9.35); exposed to harm, accident, assault or fire as compared with overexertion injury (OR, 32.31; 95% CI, 22.76–45.85); diagnosed with severe MSI such as fracture or dislocation (OR, 3.53; 95% CI, 2.64–4.68).

TABLE 1. Characteristics of Injured Workers Admitted to WCB-Alberta PTSI Rehabilitation Programs Between the Years 2017 to 2019 (n = 2,540)

| Variable                          | PTSI Only Mean ± SD or n (%) | MSK + PTSI Mean ± SD or n (%) | MSK Control Mean ± SD or n (%) | P Value |
|-----------------------------------|-----------------------------|-------------------------------|--------------------------------|---------|
| Demographic/administrative variables | n = 592                     | n = 215                       | n = 1,733                        | 0.69    |
| Age, y                            | 41.7 ± 11.4                 | 42.6 ± 12.2                  | 44.3 ± 12.4                     |         |
| Sex (% male)                      | 311 (52.5)                  | 132 (61.4)                   | 1,006 (58.0)                    | <0.001  |
| Public safety personnel (% yes)   | 252 (42.6)                  | 17 (7.9)                     | 29 (1.7)                        | <0.001  |
| Type of public safety personnel   |                             |                              |                                | <0.001  |
| Police/firefighter                | 65 (11.0)                   | 3 (1.5)                      | 15 (0.9)                        |         |
| Paramedic/emergency medical technician | 106 (17.9)              | 6 (2.8)                      | 4 (0.2)                         |         |
| Correction officer                | 81 (13.7)                   | 8 (3.7)                      | 10 (0.5)                        |         |
| Not PSP                           | 340 (57.4)                  | 198 (92.1)                   | 1,704 (98.3%)                   |         |
| Type of accident                  |                             |                              |                                | <0.001  |
| Exposure to harm                  | 261 (44.1)                  | 27 (12.6)                    | 4 (0.2)                         |         |
| Transport accidents               | 62 (10.5)                   | 74 (34.4)                    | 104 (6.0)                       |         |
| Assault/violence                  | 155 (26.2)                  | 54 (25.1)                    | 32 (1.8)                        |         |
| Overexertion and bodily reaction  | 85 (14.4)                   | 7 (3.3)                      | 1,040 (60.0)                    |         |
| Contact with objects/equipment    | 14 (2.4)                    | 26 (12.1)                    | 182 (10.5)                      |         |
| Falls                             | 6 (1.0)                     | 22 (10.2)                    | 359 (20.7)                      |         |
| Fire/explosion                    | 6 (1.0)                     | 4 (1.9)                      | 0                               |         |
| Other/unknown                     | 3 (0.5)                     | 1 (0.5)                      | 12 (0.7)                        |         |
| Diagnosis                          |                             |                              |                                | <0.001  |
| Sprain/strain                     | 0                           | 69 (32.1)                    | 944 (54.5)                      |         |
| Joint disorder                    | 0                           | 20 (9.3)                     | 411 (25.4)                      |         |
| Fracture                          | 0                           | 31 (14.4)                    | 145 (8.4)                       |         |
| Laceration/nerve damage           | 0                           | 22 (10.7)                    | 42 (2.5)                        |         |
| Contusion                          | 0                           | 24 (11.2)                    | 89 (5.1)                        |         |
| Dislocation                       | 0                           | 0                            | 26 (1.5)                        |         |
| Other (including PTSI)            | 592 (100)                   | 48 (22.3)                    | 46 (2.7)                        |         |
| Part of body                      |                             |                              |                                | <0.001  |
| Head injury                       | 558 (94.3)                  | 38 (17.7)                    | 16 (0.9)                        |         |
| Back and neck                     | 0                           | 74 (34.4)                    | 685 (39.5)                      |         |
| Extremity injury                  | 0                           | 79 (36.7)                    | 919 (53.0)                      |         |
| Multiple sites or unspecified     | 34 (5.7)                    | 24 (11.2)                    | 113 (6.5)                       |         |
| Education                         |                             |                              |                                | <0.001  |
| Partial high school or less       | 22 (3.7)                    | 20 (9.3)                     | 163 (9.4)                       |         |
| High school diploma              | 156 (26.4)                  | 87 (40.5)                    | 421 (24.3)                      |         |
| Technical school                  | 198 (33.4)                  | 56 (26.0)                    | 568 (32.8)                      |         |
| Partial university/technical school | 6 (1.0)                    | 1 (0.5)                      | 24 (1.4)                        |         |
| University degree                 | 51 (8.6)                    | 14 (6.5)                     | 110 (6.3)                       |         |
| Not specified                     | 159 (26.9)                  | 37 (17.2)                    | 447 (25.8)                      |         |
| Occupational category             |                             |                              |                                | <0.001  |
| Management                        | 31 (5.2)                    | 9 (4.2)                      | 46 (2.7)                        |         |
| Business, finance, and administration | 47 (7.9)              | 6 (2.8)                      | 100 (5.8%)                      |         |
| Natural and applied sciences and related | 9 (1.54)              | 2 (0.9)                      | 33 (1.9)                        |         |
| Health                            | 135 (22.8)                  | 22 (10.2)                    | 303 (17.7)                      |         |
| Education, law, social and community services | 176 (29.7) | 24 (11.2) | 91 (5.3) |
| Art, culture, recreation and sport | 2 (0.3)                    | 2 (0.9)                      | 14 (0.8)                        |         |
| Sales and service occupations     | 40 (6.8)                    | 37 (17.2)                    | 315 (18.2)                      |         |
| Trades                            | 138 (23.3)                  | 98 (45.6)                    | 771 (44.5)                      |         |
| Natural resources, agriculture, production | 7 (1.2) | 5 (2.3) | 54 (3.1) |
| Manufacturing and utilities       | 7 (1.2)                     | 10 (4.7)                     | 106 (6.1)                       |         |
| Injury duration (mean days)       | 229.5 (558.3)               | 248.4 (730.0)                | 128.7 (579.3)                   | <0.001  |
| Injury duration (median days)     | 84                          | 94                           | 56                              |         |
| No. previous compensation claims  | 4.3 ± 5.2                   | 3.2 ± 4.0                    | 4.2 ± 5.3                       | 0.10    |
| Employed at admission? (% yes)    | 545 (92.1)                  | 184 (85.6)                   | 1,517 (87.5)                    | 0.01    |
| Working at admission? (% yes)     | 89 (15.0)                   | 46 (21.4)                    | 722 (41.7)                      | <0.001  |
| Receiving wage replacement benefit (%yes) | 459 (77.5) | 148 (68.8) | 922 (53.2) |
| Rehabilitation program discharge outcome | Return to work | 70 (11.8) | 44 (20.5) | 863 (49.8) |
| Fit for work                      | 221 (37.3)                  | 102 (47.4)                   | 801 (46.2)                      | <0.001  |
| Not fit for work/other outcome    | 301 (50.8)                  | 69 (32.1)                    | 69 (4.0)                        |         |

PSP, public safety personnel; PTSI, posttraumatic stress injury; WCB, Workers’ Compensation Boards.

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TABLE 2. Baseline Scores on Patient-Reported Measures Completed by Injured Workers at Time of Admission to WCB-Alberta PTSI Rehabilitation Programs Between the Years 2017 to 2019

| Variable | PTSI Only | MSK + PTSI | MSK Control | P Value |
|----------|-----------|------------|-------------|---------|
|          | Mean ± SD or n (%) | Mean ± SD or n (%) | Mean ± SD or n (%) |         |
| Patient-reported measures (n = 1,297) | | | | |
| Pain VAS* (out of 100) | 34.5 ± 27.7 | 46.6 ± 25.4 | 55.6 ± 23.5 | <0.001 |
| Pain Disability Index† (out of 100) | 37.8 ± 16.4 | 42.0 ± 17.8 | 53.7 ± 19.7 | <0.001 |
| SF-36† domain scores | | | | |
| Physical Functioning (n = 990) | 33.4 ± 26.8 | 22.3 ± 21.6 | 37.0 ± 25.7 | 0.002 |
| Role Physical (n = 917) | 25.7 ± 23.5 | 23.0 ± 18.6 | 21.9 ± 22.0 | 0.57 |
| Bodily Pain (n = 1,251) | 66.9 ± 27.4 | 61.2 ± 29.1 | 29.2 ± 19.5 | <0.001 |
| General Health (n = 1,262) | 34.0 ± 19.1 | 40.7 ± 19.1 | 64.1 ± 17.6 | <0.001 |
| Vitality (n = 1,283) | 41.5 ± 14.0 | 40.3 ± 16.9 | 42.5 ± 19.5 | 0.72 |
| Social Functioning (n = 1,274) | 31.0 ± 21.4 | 34.7 ± 25.8 | 43.1 ± 23.9 | <0.001 |
| Role Emotional (n = 1,099) | 33.3 ± 27.1 | 30.7 ± 27.3 | 40.3 ± 30.6 | 0.12 |
| Mental Health (n = 1,279) | 38.1 ± 14.6 | 45.0 ± 10.0 | 54.4 ± 19.8 | <0.001 |

PTSI, posttraumatic stress injury; SF-36, 36-item Short-Form Health Survey; V AS, Visual Analog Scale.

*The pain V AS is a single-item patient-reported measure of pain intensity within the last 24 hours.
†The Pain Disability Index is a seven-item patient-report measure used to assess a respondents' perceived degree of pain-related impairment.
‡The SF-36 is a widely used quality of life tool that measures eight domains of physical health, psychological health, and other aspects of well-being.

CI, 2.49–5.01) or other injury (including PTSI) (OR, 14.28; 95% CI, 8.90–22.90); or had a high school education or less (OR, 1.95; 95% CI, 1.47–2.59). Workers had lower odds of developing PTSI if they had more previous compensation claims (OR, 0.95; 95% CI, 0.92–0.98) or experienced injuries of the back/neck (OR, 0.23; 95% CI, 0.15–0.33) or extremities (OR, 0.18; 95% CI, 0.12–0.26) as compared with injuries of the head or multiple sites.

The adjusted ORs of variables in the final multivariable logistic regression model (shown in Table 3) indicated that workers were at higher odds of developing PTSI if they were public safety personnel (OR, 3.11; 95% CI, 1.22–7.91); exposed to harm, accident, assault or fire as compared with overexertion injury (OR, 25.84; 95% CI, 17.38–38.42); diagnosed with severe MSI such as fracture or dislocation (OR, 3.70; 95% CI, 2.33–5.89), or other injury (including PTSI) (OR, 4.69; 95% CI, 2.25–9.79); or had a high school education or less (OR, 1.94; 95% CI, 1.33–2.82). Number of previous workers' compensation claims was no longer significant in final models.

Patient-Reported Risk Factors for Developing Concurrent PTSI After MSI

When exploring patient-reported measures, both the pain V AS and Pain Disability Index were statistically significant univariate predictors (P < 0.05) along with several SF-36 domains (Physical Functioning, Bodily Pain, General Health, Mental Health).

TABLE 3. Logistic Regression Analysis Examining Risk Factors for PTSI in Workers Experiencing MSI (n = 1,948)

| Variable | Unadjusted Odds Ratio (95% CI) | P | Adjusted Odds Ratio (95% CI) | P |
|----------|-------------------------------|---|-----------------------------|---|
| Demographic and occupational factors | | | | |
| Age | 0.99 (0.98–1.00) | 0.06 | 1.00 (0.99–1.02) | 0.72 |
| Sex | Male 1.0 | Female 0.97 (0.72–1.30) | 0.83 | |
| Public safety personnel (% yes) | 5.05 (2.72–9.35) | <0.001 | 3.11 (1.22–7.91) | 0.02 |
| Type of accident | | | | |
| Overexertion/falls/other | 1.0 | | | |
| Harm/accidents/assault/fire | 32.31 (22.76–45.85) | <0.001 | 25.84 (17.38–38.42) | <0.001 |
| Diagnosis | | | | |
| Sprain/strain | 1.0 | | | |
| Fracture/dislocation/specific injury | 3.53 (2.49–5.01) | <0.001 | 3.70 (2.33–5.89) | <0.001 |
| Joint disorder | 0.62 (0.37–1.03) | 0.07 | 0.52 (0.29–0.93) | 0.03 |
| Other injury including PTSI | 14.28 (8.90–22.90) | <0.001 | 4.69 (2.25–9.79) | <0.001 |
| Part of body | | | | |
| Head, multiple sites or unspecified | 1.0 | | | |
| Back and neck | 0.23 (0.15–0.33) | <0.001 | 0.67 (0.35–1.26) | 0.21 |
| Arm and leg | 0.18 (0.12–0.26) | <0.001 | 0.63 (0.34–1.17) | 0.14 |
| Education | | | | |
| More than high school diploma | 1.0 | | | |
| High school or less | 1.95 (1.47–2.59) | <0.001 | 1.94 (1.33–2.82) | <0.001 |
| Occupational category | | | | |
| Trades | 1.0 | | | |
| Other | 0.96 (0.72–1.27) | 0.76 | 0.98 (0.93–1.02) | 0.33 |
| No. previous compensation claims | 0.95 (0.92–0.98) | 0.01 | |

P, pain; PTSI, posttraumatic stress injury; SF-36, 36-item Short-Form Health Survey; V AS, Visual Analog Scale.

CI, confidence interval; MSI, musculoskeletal injury; PTSI, posttraumatic stress injury.
Bodily Pain, General Health, Social Functioning, and Mental Health [Table 4]. Higher pain and disability levels were associated with lower odds of experiencing concurrent MSI and PTSI. Entering all significant patient-reported variables into a final model resulted in only the SF-36 Bodily Pain, General Health, and Social Functioning domains remaining predictive. Better Bodily Pain scores were associated with increased odds of concurrent MSI and PTSI (OR, 1.08; 95% CI, 1.05–1.11), whereas better General Health (OR, 0.95; 95% CI, 0.92–0.98) and Social Functioning (OR, 0.96; 95% CI, 0.93–0.99) were both associated with decreased odds of concurrent MSI and PTSI.

### DISCUSSION

In this case-control study examining risk factors for developing concurrent MSI and PTSI, a variety of accident and injury-related variables were found influential. Public safety personnel are at higher odds of concurrent MSI and PTSI, likely because of the high-risk nature of the work conducted by police, firefighters, and paramedics and possibility of exposure to potentially traumatic events including transport accidents, fire, or assault. Workers exposed to these types of events in the workplace were at much higher odds (adjusted OR, 25.84) of developing concurrent MSI and PTSI. These types of workplace exposures are also more likely to lead to severe injury, such as fracture or dislocation. Diagnoses of severe MSI injuries such as fractures and dislocations also had higher odds of concurrent PTSI than sprain/strain injuries. In summary, the odds of experiencing concurrent MSI and PTSI diagnoses after work-related accident and injury appears highly dependent on the nature of work conducted and types of accidents and injuries workers experience. Findings are consistent with previous research that has found that the nature of work and types of accidents and injuries workers experience are related to development of PTSI.\(^1,5\) Our sample of workers with concurrent MSI and PTSI also reported worse general health and worse social functioning and had less attachment to the workplace (including being less likely to be working at admission and discharge from rehabilitation), which is consistent with previous research.\(^4,5\) Our findings related to patient-reported pain intensity and disability were not consistent with previous research. We found that workers reporting higher pain and disability were at lower odds of developing concurrent MSI and PTSI. This is contrary to previous results that identified sustained high levels of pain intensity as predictive of developing posttraumatic stress symptoms.\(^8\) These inconsistent findings could be due to the nature of our outcome, which was diagnosed PTSI rather than only experiencing symptoms of posttraumatic stress. It may also be due to the fact our patient-reported measures were not completed at the time of the accident but upon first admission for rehabilitation.

Our findings are consistent with suggestions that early clinical ratings of pain and disability or other patient-reported psychological or stress-related screening tools could help identify those most at risk of PTSI after MSI.\(^3,9,11\) Further research is needed on preexisting mental health conditions or exposures to psychological trauma and risk of developing PTSI. Previous mental health problems may lower resilience in the face of MSI or other trauma as well as increase the risk of poor PTSI outcomes. Previous mental health issues may also be associated with lower education attainment,\(^28\) worse general health,\(^29\) and worse social functioning.\(^30,31\) Previous research has highlighted that a diagnosis of posttraumatic stress disorder is associated with reduced educational performance across the lifespan,\(^32,33\) but to our knowledge, ours is the first study to identify lower educational background as a risk factor for developing PTSI. To examine these issues in more depth, well-designed prospective studies are needed to follow cohorts of workers experiencing workplace injuries and accidents, ideally with biopsychosocial characteristics of the workers and workplaces measured before the injury event occurs.

### Limitations

Limitations of the current study include reliance on archived data from the WCB-Alberta, which may limit generalizability, and large amounts of missing data on the patient-reported measures. Our study relied on accepted claims within one workers’ compensation jurisdiction, and thus, our findings may reflect local policies or decision making. This may also have underestimated the frequency of workers experiencing posttraumatic stress symptoms who ultimately did not seek or receive treatment for PTSI within WCB-Alberta programs. Significant univariate associations were observed with a variety of clinical measures; however, because of the amount of missing data and the fact that these measures were not collected at time of initial injury, we did not include these variables in the final full model. There were also important differences between those with and without missing data, indicating the introduction of potential bias by including these variables in the models. Further prospective studies with more complete data sets are needed to reduce possible bias in the determination of associations and the predictive value of patient-reported factors.

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