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Original research

Prevalence and risk factors for anxiety and depression disorders in workers with work-related musculoskeletal strain or sprain in British Columbia, Canada: a comparison of men and women using administrative health data

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ABSTRACT

Objective To examine the prevalence and risk factors for medically treated anxiety and depression disorders among men and women with musculoskeletal strain or sprain work injury in British Columbia, Canada.

Methods A retrospective population-based cohort of accepted workers' compensation lost-time claims from 2000 to 2013 was constructed using linked administrative health data. Anxiety and depression disorders were identified using diagnoses from physician, hospital and pharmaceutical records. The 1-year period prevalence was estimated for the year before and the year after injury. Sociodemographic, clinical and work-related risk factors for prevalent and new onset anxiety and depression disorders were examined using multinomial regression.

Results 13.2% of men and 29.8% of women had medically treated anxiety, depression or both in the year before injury. Only a slight increase (~2%) in the prevalence of these disorders was observed in the year after injury. Somatic and mental comorbidities were both strong risk factors for pre-existing and new onset anxiety and depression for both men and women, but these relationships were stronger for men.

Conclusion Anxiety and depression disorders including those from prior to injury are common in workers with musculoskeletal strain or sprain and are associated with a complicated clinical profile. Gender-sensitive and sex-sensitive mental healthcare is an important consideration for work disability management.

Key messages

What is already known about this subject?

- Anxiety and depression disorders are common in workers with long-term disability or permanent impairment due to work injury.
- The prevalence and risk factors for anxiety and depression disorders in workers with short-term disability for musculoskeletal strain or sprain are not well described.

What are the new findings?

- Approximately 1 in 10 men and 3 in 10 women had a medically treated anxiety or depression disorder in the year before injury.
- A similar but slightly elevated prevalence was observed in the year after injury.
- Somatic and mental comorbidities were both strong determinants of prevalent and new onset anxiety and depression disorders, for both men and women, but these relationships were stronger for men, and for prevalent conditions.

How might this impact on policy or clinical practice in the foreseeable future?

- Pre-existing anxiety and depression disorders in addition to those that develop after injury are important considerations for injured workers' mental health.
- Gender-sensitive and sex-sensitive mental health services may have the potential to improve work disability management of musculoskeletal strain or sprain.

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INTRODUCTION

Musculoskeletal injury is a major contributor to disability burden in high-income countries around the world.[1] In the Canadian province of British Columbia, the most common type of work-related musculoskeletal condition is sprain or strain which accounts for over half of all lost-time workers' compensation claims, 57% of all registered lost workdays due to work-related injury or illness and $C347 million in disability costs annually.[2]

In workers with chronic work disability or permanent impairment due to work injury or illness, prevalence estimates range from 40% to 55% for depression disorders and 11% for anxiety.[3–6] Comparable general population estimates range from 11% to 12% for depression and 7% for anxiety.[3–6] An increased risk of new onset anxiety and depression disorders after work injury and the contribution of pre-existing anxiety and depression disorders to work injury occurrence and chronicity likely contribute to these findings.[7 8] Possible mechanisms include shared neuroanatomical pathways and transmitters,[8 9] the socioemotional effects of injury and disability,[10] and increased injury risk due

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to pharmacological treatment and symptoms of fatigue and inattention.[11 12]

In the general population, anxiety and depression disorders are twice as prevalent in women than in men[13]; but similar estimates for injured workers are lacking. It is also unknown if work injury impacts men and women's risk of new onset anxiety and depression disorders differentially, or if the risk profile for these disorders varies for men and women. Recent studies suggest that after musculoskeletal work injury, Canadian women's work disability duration is longer than men's[14]; and that depressive symptoms are a risk factor for poor return to work.[15] Differences in men and women's mental health experiences might contribute to differences in disability duration.

A better understanding of anxiety and depression disorder prevalence before and after musculoskeletal strain or sprain work injury, as well as their risk factors, could inform the use of mental health interventions to improve return to work. Understanding of how men and women's experiences of mental health vary is also needed to inform gender/sex-sensitive delivery of these interventions. Limitations of prior research include use of self-reported anxiety and depression symptoms or diagnoses prone to recall and social desirability biases[3–6]; and small clinical samples prone to selection biases and limited external generalisability.[3–5] In most cases, studies have focused on workers with chronic work disability or permanent impairment.[3–6] In addition, workers with pre-existing mental disorders are often excluded[15] and estimates specific to men or women are limited. The current study sought to address the preceding limitations using population-based, administrative health data for the province of British Columbia. Using musculoskeletal spine or upper limb strain or sprain as the most commonly occurring work injury claim and leading cause of compensated lost-time, the objectives were to investigate the following for both men and women (separately), and to identify gender/sex-based differences in:

1. The 1-year period prevalence of anxiety, depression and comorbid anxiety and depression disorders in the year before and the year after injury.
2. Sociodemographic, injury, clinical and work-related risk factors for
    1. Prevalent anxiety, depression and comorbid anxiety and depression disorders in the year prior to injury.
    2. New onset anxiety, depression and comorbid anxiety and depression disorders in the 3 months after injury.

METHODS

Data sources

Longitudinal administrative data from British Columbia's workers' compensation (WorkSafeBC) and public healthcare (Ministry of Health) systems were linked by Population Data BC.[16–20] During the study period, 93%–95% of workers were covered for workers' compensation insurance,[21] and public healthcare was universal for residents.

Study sample

The study sample included lost-time workers' compensation claims for musculoskeletal spine or upper limb strain or sprain from 2000 to 2013, for workers 19–64 years of age. Eligible claims were identified using International Classification for Disease version 9 (ICD-9) codes 840, 841, 842, 846 and 847.[22] Registration in the public healthcare plan for at least 275 days in both the years before and after injury was required to ensure full capture of the outcomes. Of the 317 512 eligible lost-time claims, 7.1% (n=22 599) were excluded due to insufficient registration in the public healthcare plan, and another 0.9% (n=2748) for missing data. The final study sample included 292 165 claims.

Outcome variables

Definitions for anxiety and depression disorders were based on a review of studies using Canadian administrative health data.[23] Depression cases were defined by an index event and a confirmatory event within 12 months of the index event (where applicable), as follows: (1) a hospitalisation index event with a depression diagnosis, (2) an antidepressant index event and a physician or hospital visit with a depression diagnosis within 12 months of the antidepressant index event or (3) a physician index visit with a depression diagnosis and a second physician or hospital visit for depression, or an antidepressant event within 12 months of the index visit. Similar rules were used to classify anxiety, with the exception that anxiety diagnoses were used and both anxiolytics and antidepressants were included. Antidepressants are a recommended first-line pharmacotherapy agent for most common anxiety disorders.[24] The Anatomical Therapeutic Chemical classification system was used to identify anxiolytics (N05B) and antidepressants (N06A),[25] while the ICD-9 and ICD-10-CA systems were used to identify anxiety (ICD-9 300.x, 308.x, 309.x; ICD-10-CA F4x, F68.x, F34.1) and depression (ICD-9 311.x, 296.x; ICD-10-CA F3x [F34.1 excluded]) diagnoses. Lastly, diagnostic code 50b (anxiety/depression) unique to British Columbian physician billing claims was included as a diagnosis for both anxiety and depression. The physician billing data used the ICD-9 system where only the first three digits were required from practitioners. The hospital data used the ICD-9 system until 2001/2002 when a switch to the ICD-10-CA system was made. Umbrella case definitions for anxiety and depression were developed where detailed ICD-10-CA codes were mapped to the less specific three-digit ICD-9 codes. Similar case definitions have demonstrated moderate sensitivity and high specificity compared with medical records and the composite international diagnostic interview.[26]

Risk factors

Risk factors for anxiety and depression disorders were included based on a review of the return-to-work and mental health literature, and the availability of variables (see table 1 for detailed risk factor categories).

Sociodemographic risk factors included (1) gender/sex, (2) age group, (3) pre-injury personal income quintile, (4) dependent(s) under 19 years of age in the household and (5) urban versus rural residence.

Injury risk factors included (1) body part, (2) incident type and (3) secondary injury claim diagnosis other than anxiety or depression.

Clinical risk factors included (1) number of workers' compensation claims in the last 5 years, (2) presence of mental disorders other than anxiety or depression (defined by ICD-9 codes 290 to 319 or ICD 10 codes F01 to F99), and (3) somatic comorbidity index score (See online supplemental file 1). Anxiety and/or depression disorders from prior to the year before injury (health data back to 1991) was included as a risk factor in the analyses of new onset anxiety or depression.

Work-related risk factors included (1) firm size, (2) shift type and (3) standardised occupation groups.[27]

Analyses

The 1-year period prevalence of anxiety, depression and comorbid anxiety and depression was calculated as the number

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Table 1 Sociodemographic, injury, clinical and work factors among lost-time upper limb or spine strain or sprain claims in British Columbia from 2000 to 2013

	Men (n=175 566) n (%)	Women (n=116 599) n (%)
Sociodemographic		
Age group (years)		
19–24	19 440 (11.1)	9053 (7.8)
25–29	19 568 (11.2)	10 221 (8.8)
30–39	45 577 (26.0)	26 804 (23.0)
40–49	50 231 (28.6)	38 241 (32.8)
50–59	33 925 (19.3)	28 059 (24.1)
60–64	6825 (3.9)	4221 (3.6)
Income quintile		
1: lowest	23 246 (13.2)	31 923 (27.4)
2	30 178 (17.2)	26 913 (23.1)
3	31 984 (18.2)	27 530 (23.6)
4	43 214 (24.6)	16 923 (14.5)
5: highest	46 944 (26.7)	13 310 (11.4)
Dependents		
0	112 744 (64.2)	70 535 (60.5)
1 or more	158 404 (35.7)	46 064 (39.5)
Location		
Urban	158 404 (90.2)	104 382 (89.5)
Rural	17 162 (9.8)	12 217 (10.5)
Injury		
Injured body part		
Sacroiliac	26 341 (15.0)	14 967 (12.8)
Back/neck	101 907 (58.0)	68 508 (58.8)
Upper limb	47 318 (27.0)	33 124 (28.4)
Incident type		
Exertion/repetitive motion	30 885 (51.7)	55 934 (48.0)
Traumatic	2529 (1.4)	4797 (4.1)
Fall/slip/trip	29 219 (16.6)	21 470 (18.4)
Contact object	10 457 (6.0)	7213 (6.2)
Transportation	11 686 (6.7)	3965 (3.4)
Bodily motion	30 885 (17.6)	23 220 (19.9)
Secondary claim diagnosis		
No	148 640 (84.7)	89 083 (76.4)
Yes*	27 010 (15.3)	27 516 (23.6)
Clinical		
Somatic comorbidity		
0	19 029 (10.8)	4461 (3.8)
1	35 301 (20.1)	12 400 (10.6)
2	40 090 (22.8)	20 143 (17.3)
3	34 600 (19.7)	23 578 (20.2)
4	22 996 (13.1)	21 312 (18.3)
5 or more	23 550 (13.4)	34 705 (29.8)
Mental comorbidity		
0	168 158 (95.8)	112 116 (96.2)
1 or more*	7408 (4.2)	4483 (3.8)
Clinical		
Prior claims		
0	57 425 (32.7)	50 600 (43.4)
1	45 117 (25.7)	29 481 (25.2)
2	29 133 (16.6)	16 430 (14.1)
3 or more	43 891 (25.0)	20 088 (17.2)
Work		
Firm size		
30 or less	54 154 (30.9)	17 963 (15.4)
31–150	47 275 (26.9)	23 479 (20.1)
151–1000	42 737 (24.3)	26 357 (22.6)
1001–10 000	28 086 (16.0)	27 762 (23.8)
10 001 or more	3314 (1.89)	21 038 (18.0)
Shift type		
Fixed	144 520 (82.3)	84 332 (72.3)
Other	31 046 (17.7)	32 267 (27.7)
Occupation		
Sales and services	25 368 (14.5)	44 518 (38.2)
Art, culture, recreation, sport	1312 (0.8)	1636 (1.4)
Business, finance, administration	8202 (4.7)	7085 (6.1)
Health	5983 (3.4)	37 836 (32.5)
Management	2620 (1.5)	2564 (2.2)
Natural and applied sciences	3711 (2.1)	644 (0.6)
Primary industry	7030 (4.0)	1716 (1.5)
Processing, manufacturing, utilities	22 319 (12.7)	5565 (4.8)
Social science, education, government	1983 (1.1)	8097 (6.9)
Trades, transport, equipment operators	97 038 (55.3)	6938 (6.0)

*Anxiety and depression not included.

of claims meeting the case definition during the time period of interest divided by the total number of claims in the study sample.

For the analyses of risk factors for prevalent anxiety or depression at the time of injury, claims with an anxiety or depression-related healthcare event in the year prior to injury that did not meet the case definitions were excluded (8.8%, n=25 676 excluded; n=266 489 claims remaining). For the analyses of risk factors for new onset anxiety or depression in the 3 months after injury, claims with any anxiety or depression-related healthcare event in the year before injury were excluded (28.2%, n=82 260 584 excluded; n=209 905 claims remaining).

Multinomial logistic regression models were used to investigate the risk factors (ORs with 95% CI) for anxiety only, depression only and comorbid anxiety and depression, compared with having none of these disorders. Separate models were constructed for prevalent pre-injury and new onset post-injury cases. Adhering to recommended guidelines, all analyses were stratified by sex.[28] Analyses were conducted using SAS V.9.4.

RESULTS

Study sample

In this sample of accepted workers' compensation claims for musculoskeletal strain or sprain, over half of the claims occurred among men (60.1%) (table 1). Women were less likely to be in the higher income deciles than men (11.4% vs 26.7% for the highest decile) and more likely to have a somatic comorbidity score of 5 or higher than men (29.8% vs 13.4%). The most common occupational group for men were trades, transport or equipment operators (55.3%); and for women, sales and services (38.2%) and health (32.5%). Finally, women were more likely to work in very large firms than men (18.0% vs 1.9%) and less likely to work in very small firms (15.0% vs 30.1%).

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Table 2 One-year period prevalence of medically treated anxiety and depression disorders for the year before and the year after injury (row percentages reported)

	None	Anxiety only	Depression only	Anxiety and depression*	Total anxiety†	Total depression†
Men n=175 566						
1 year pre-injury	86.8	3.9	2.8	6.5	10.4	9.3
1 year post-injury	84.6	4.5	3.1	7.7	12.2	10.8
Women n=116 599						
1 year pre-injury	71.2	8.0	5.3	15.4	23.4	20.7
1 year post-injury	68.5	8.7	5.7	17.0	25.7	22.7

*Includes all claims that met both the anxiety and the depression case definitions (ie, comorbid anxiety and depression).
†Includes all claims with the indicated disorder (eg, anxiety alone and comorbid anxiety and depression; or depression alone and comorbid anxiety and depression).

Prevalence of anxiety and depression

Among women, the prevalence of anxiety or depression was 23.4% and 20.7%, respectively, in the year before injury, and 25.7% and 22.7% in the year post injury, of which the majority was comorbid anxiety and depression (table 2). Among men, the prevalence of anxiety or depression was lower at 10.4% and 9.3% in the year before injury, and 12.2% and 10.8% in the year after injury. Again, the majority of this prevalence was for comorbid anxiety and depression.

Shared risk factors for men and women for prevalent (pre-injury) anxiety and depression disorders

In the fully adjusted models (table 3), the odds of anxiety only, depression only, and comorbid anxiety and depression in the year before injury were elevated with older age and highest among those in their 30s and 40s, compared with those aged 19−24 years. The odds for all three outcomes were reduced with more income and were lowest among those in the fifth compared with the first income decile. In terms of injury characteristics, the odds of the three mental outcomes were elevated for upper back and neck injury locations compared with lower back locations. With few exceptions, the odds of all the three outcomes were elevated for different incident injury types compared with over-exertion injuries, although many of the estimates had confidence intervals that included '1'. For work characteristics, compared with those working in sales and service occupations, both men and women working in health occupations and social sciences/education occupations had elevated odds of all three outcomes, while those in processing/manufacturing and natural/applied science occupations had no effect or decreased odds. Finally, all of the clinical characteristics (a higher somatic comorbidity index score, a higher number of prior claim(s), and the presence of other mental comorbidities) were associated with higher odds of all three outcomes.

Key differences in risk profiles for prevalent (pre-injury) anxiety versus depression disorders

While there was a strong positive relationship between the somatic comorbidity index and the three mental health outcomes in the year before injury, the effect sizes were greater for anxiety only and comorbid anxiety and depression, than for depression only, for both men and women (table 3).

Key differences in men's versus women's risk profiles for prevalent (pre-injury) anxiety and depression disorders

Having a dependent in the home was a protective factor for comorbid anxiety and depression in both men and women, but the effect size was greater for men (table 3). Conversely, having a dependent in the home was a protective factor for anxiety only in men and a risk factor for women. Rural living was a risk factor for comorbid anxiety and depression in women and a protective factor for men. It was also a risk factor for anxiety only in men but not women. Compared with women with sacroiliac injuries, women with upper limb injuries had lower odds of all three outcomes, but this effect was not seen for men. Having a secondary diagnosis to the strain or sprain claim was positively associated with anxiety only in men, but not women. Clinical risk factors were similar for men and women, but the effect sizes for the somatic and mental comorbidity variables were in general, greater for men than for women. For the work variables, a positive dose–response relationship between increasing firm size and odds of all three outcomes was observed for men, but not women. Women working in business, finance and administration had increased odds of all three outcomes compared with women in sales and services—but this occupational risk was not observed for men. Increased odds were also observed for men and women in health occupations but more so for men. Women in trades, transport and equipment operation occupations also had an increased odds of comorbid anxiety and depression that was not observed among men in the same occupation.

New onset anxiety and depression disorders

There were 139 100 men and 70 805 women with no anxiety or depression related healthcare events in the year before injury. Of these, 1.0% (n=1315) of men and 1.9% (n=1357) of women developed anxiety only, 0.4% (n=609) of men and 0.8% (n=577) of women developed depression only, and 0.7% (n=956) of men and 1.3% (n=950) of women developed co-morbid anxiety and depression in the 3 months after injury.

Key differences in risk profiles for new onset (post-injury) versus prevalent (pre-injury) anxiety and depression disorders

Increasing age was associated with decreasing odds of new onset anxiety, depression and comorbid anxiety and depression in the 3 months after injury, although this pattern was more consistent for women compared with men (table 4). Traumatic injuries, compared with over exertion injuries, had a stronger association with new onset versus prevalent, anxiety and depression outcomes. The clinical variables (somatic comorbidity; mental comorbidity other than depression or anxiety, and prior claims) showed similar directions of effect in the prevalence and new onset models, but the effect estimates were notably smaller in magnitude for the three new onset outcomes. Conversely, the presence of a secondary injury diagnosis on the claim had a stronger positive association with the three new onset outcomes, than was observed for prevalent anxiety and depression. For new onset versus prevalent outcomes, the effects for occupation type

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Table 3 Adjusted OR with 95% CI for risk factors of prevalent medically treated anxiety and depression disorders in the year before injury, multinomial logistic regression

	Men			Women		
	Anxiety only	Depression only	Anxiety and depression	Anxiety only	Depression only	Anxiety and depression
Sociodemographic						
Age group (years)						
19–24	1	1	1	1	1	1
25–29	1.42 (1.25–1.61)	1.38 (1.20–1.60)	1.54 (1.40–1.70)	1.29 (1.14–1.45)	1.48 (1.28–1.70)	1.41 (1.29–1.55)
30–39	1.72 (1.54–1.93)	1.77 (1.56–2.00)	2.00 (1.84–2.18)	1.63 (1.47–1.82)	1.78 (1.56–2.01)	1.88 (1.73–2.04)
40–49	1.91 (1.71–2.13)	2.03 (1.80–2.30)	2.09 (1.91–2.27)	1.73 (1.56–1.92)	1.76 (1.56–1.99)	1.85 (1.71–2.00)
50–59	1.75 (1.56–1.96)	1.76 (1.55–2.00)	1.74 (1.59–1.90)	1.68 (1.52–1.87)	1.73 (1.53–1.96)	1.63 (1.51–1.76)
60–64	1.57 (1.34–1.83)	1.27 (1.05–1.54)	1.12 (0.98–1.28)	1.66 (1.44–1.93)	1.38 (1.15–1.65)	1.29 (1.15–1.45)
Income quintile						
1: lowest	1	1	1	1	1	1
2	0.93 (0.84–1.02)	0.87 (0.79–0.97)	0.83 (0.77–0.89)	0.97 (0.91–1.04)	0.85 (0.79–0.92)	0.86 (0.82–0.90)
3	0.93 (0.85–1.02)	0.84 (0.76–0.93)	0.80 (0.75–0.86)	0.94 (0.87–1.00)	0.81 (0.75–0.88)	0.78 (0.74–0.82)
4	0.93 (0.85–1.02)	0.80 (0.72–0.89)	0.77 (0.71–0.82)	0.84 (0.77–0.91)	0.77 (0.71–0.85)	0.69 (0.65–0.74)
5: highest	0.83 (0.75–0.91)	0.73 (0.66–0.81)	0.66 (0.62–0.71)	0.81 (0.75–0.89)	0.72 (0.65–0.80)	0.64 (0.59–0.68)
Dependents						
0	1	1	1	1	1	1
1 or more	0.96 (0.91–1.01)	0.86 (0.81–0.92)	0.87 (0.83–0.90)	1.08 (1.03–1.13)	0.91 (0.86–0.97)	0.97 (0.93–1.01)
Location						
Urban	1	1	1	1	1	1
Rural	0.85 (0.78–0.93)	1.08 (0.98–1.19)	0.89 (0.83–0.96)	0.98 (0.91–1.05)	1.19 (1.10–1.29)	1.07 (1.01–1.13)
Injury						
Injured body part						
Sacroiliac	1	1	1	1	1	1
Back/neck	1.11 (1.03–1.19)	1.13 (1.04–1.23)	1.12 (1.06–1.19)	1.08 (1.01–1.16)	1.07 (0.98–1.15)	1.09 (1.03–1.15)
Upper limb	1.04 (0.96–1.13)	1.07 (0.97–1.18)	1.08 (1.02–1.16)	0.94 (0.87–1.01)	0.91 (0.83–0.99)	0.91 (0.86–0.97)
Incident type						
Exertion	1	1	1	1	1	1
Traumatic	1.06 (0.88–1.29)	1.17 (0.94–1.47)	1.16 (1.00–1.35)	1.25 (1.12–1.39)	1.11 (0.97–1.27)	1.33 (1.23–1.45)
Fall/slip/trip	1.08 (1.01–1.16)	1.06 (0.97–1.15)	1.17 (1.11–1.24)	1.16 (1.09–1.24)	1.14 (1.06–1.23)	1.16 (1.11–1.22)
Contact object	1.04 (0.93–1.16)	1.01 (0.89–1.14)	1.09 (1.00–1.19)	1.10 (1.00–1.21)	1.04 (0.92–1.16)	1.07 (0.99–1.15)
Transportation	1.13 (1.02–1.25)	1.00 (0.89–1.13)	1.16 (1.07–1.25)	0.93 (0.81–1.07)	0.96 (0.82–1.12)	1.11 (1.00–1.22)
Bodily motion	1.03 (0.96–1.11)	1.04 (0.96–1.12)	1.07 (1.01–1.13)	1.04 (0.98–1.11)	1.03 (0.96–1.11)	1.07 (1.02–1.12)
Secondary claim diagnosis						
No	1	1	1	1	1	1
Yes*	1.13 (1.05–1.21)	1.02 (0.94–1.11)	1.06 (1.01–1.12)	1.01 (0.96–1.07)	0.94 (0.88–1.00)	1.02 (0.98–1.07)
Clinical						
Somatic comorbidity						
0	1	1	1	1	1	1
1	1.64 (1.41–1.90)	1.48 (1.29–1.71)	1.49 (1.34–1.66)	1.74 (1.44–2.12)	1.50 (1.24–1.81)	1.60 (1.39–1.84)
2	2.50 (2.18–2.88)	1.93 (1.69–2.21)	2.24 (2.02–2.48)	2.39 (1.99–2.87)	1.73 (1.45–2.07)	2.14 (1.88–2.45)
3	3.56 (3.10–4.08)	2.31 (2.01–2.64)	3.02 (2.72–3.35)	3.06 (2.55–3.67)	2.06 (1.73–2.46)	2.84 (2.49–3.24)
4	4.43 (3.84–5.10)	2.63 (2.28–3.02)	4.12 (3.71–4.58)	3.71 (3.09–4.45)	2.29 (1.92–2.73)	3.56 (3.12–4.06)
5 or more	7.36 (6.41–8.44)	3.43 (2.99–3.94)	6.39 (5.77–7.08)	5.79 (4.84–6.92)	3.00 (2.52–3.56)	5.47 (4.81–6.23)
Mental comorbidity						
0	1	1	1	1	1	1
1 or more*	4.50 (4.13–4.90)	4.80 (4.36–5.29)	6.63 (6.22–7.06)	2.98 (2.68–3.31)	3.42 (3.04–3.84)	5.24 (4.85–5.65)
Prior claims						
0	1	1	1	1	1	1
1	1.09 (1.01–1.16)	1.04 (0.96–1.12)	1.06 (1.00–1.12)	1.09 (1.03–1.16)	1.09 (1.02–1.16)	1.17 (1.12–1.22)
2	1.17 (1.09–1.27)	1.02 (0.93–1.11)	1.16 (1.09–1.23)	1.20 (1.12–1.29)	1.25 (1.15–1.35)	1.30 (1.24–1.37)
3 or more	1.36 (1.27–1.46)	1.32 (1.22–1.43)	1.37 (1.30–1.45)	1.45 (1.36–1.54)	1.33 (1.23–1.43)	1.50 (1.43–1.57)
Work						
Firm size						

continued

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Table 3 continued

	Men			Women		
	Anxiety only	Depression only	Anxiety and depression	Anxiety only	Depression only	Anxiety and depression
30 or less	1	1	1	1	1	1
31–150	0.99 (0.92–1.06)	1.00 (0.93–1.09)	1.01 (0.96–1.07)	0.93 (0.86–1.00)	0.91 (0.83–0.99)	0.93 (0.88–0.98)
151–1000	1.06 (0.99–1.14)	1.02 (0.94–1.11)	1.07 (1.01–1.13)	0.86 (0.80–0.93)	0.81 (0.74–0.88)	0.83 (0.79–0.88)
1001–10 000	1.18 (1.09–1.28)	1.10 (1.00–1.21)	1.18 (1.11–1.26)	0.97 (0.90–1.04)	0.94 (0.86–1.03)	0.99 (0.93–1.05)
10 001 or more	1.22 (1.03–1.44)	1.21 (0.99–1.48)	1.29 (1.13–1.48)	0.94 (0.87–1.03)	1.02 (0.92–1.13)	1.07 (1.00–1.14)
Shift type						
Fixed	1	1	1	1	1	1
Other	0.96 (0.90–1.03)	0.97 (0.90–1.05)	1.05 (1.00–1.11)	0.95 (0.90–1.00)	1.00 (0.94–1.06)	1.01 (0.98–1.06)
Occupation						
Sales and services	1	1	1	1	1	1
Art, culture, recreation, sport	0.78 (0.56–1.08)	0.83 (0.57–1.19)	0.80 (0.62–1.02)	0.97 (0.79–1.18)	1.10 (0.87–1.38)	1.06 (0.91–1.23)
Business, finance, administration	1.01 (0.89–1.15)	0.94 (0.81–1.10)	0.95 (0.86–1.06)	1.13 (1.03–1.25)	1.34 (1.19–1.49)	1.28 (1.19–1.38)
Health	1.62 (1.41–1.85)	1.40 (1.19–1.65)	1.34 (1.20–1.50)	1.11 (1.04–1.18)	1.11 (1.03–1.20)	1.11 (1.06–1.17)
Management	1.06 (0.85–1.30)	1.03 (0.80–1.32)	0.98 (0.83–1.17)	1.15 (0.99–1.34)	1.22 (1.02–1.46)	1.04 (0.92–1.18)
Natural and applied sciences	0.95 (0.79–1.15)	1.00 (0.81–1.25)	0.92 (0.79–1.07)	0.77 (0.55–1.08)	0.74 (0.49–1.13)	0.82 (0.63–1.06)
Primary industry	0.99 (0.85–1.14)	0.93 (0.79–1.11)	0.90 (0.80–1.01)	0.68 (0.55–0.85)	0.90 (0.71–1.13)	1.02 (0.88–1.18)
Processing, manufacturing, utilities	0.87 (0.79–0.97)	0.90 (0.80–1.02)	0.85 (0.78–0.92)	0.64 (0.57–0.72)	0.81 (0.70–0.93)	0.79 (0.73–0.87)
Social science, education, government	1.33 (1.08–1.64)	1.08 (0.83–1.42)	1.36 (1.15–1.60)	1.27 (1.16–1.39)	1.53 (1.38–1.70)	1.40 (1.31–1.50)
Trades, transport, equipment operators	0.94 (0.87–1.01)	0.97 (0.89–1.06)	0.89 (0.84–0.95)	0.95 (0.85–1.05)	1.09 (0.96–1.22)	1.11 (1.03–1.20)

*Anxiety and depression not included.

were more variable in terms of direction and size of effect by gender/sex and by type of condition.

DISCUSSION

The current study suggests that anxiety and depression disorders are common among a Canadian working population with short-term disability due to musculoskeletal strain or sprain work injury but more so for women than for men. Only a small increase in prevalence (~2%) was observed from pre-injury to post-injury. This suggests that musculoskeletal strain or sprain work injury is not a major stimulus of new onset anxiety and depression disorders in men or women. Lastly, among a multifactorial risk profile, clinical characteristics were the strongest factors associated with anxiety and depression disorders, but more so for prevalent than new onset cases, and for men than for women.

Prevalence

The prevalence of post-injury depression disorders found here for workers with short-term disability (11% for men and 23% for women) is low compared with other studies of injured workers with permanent impairment or chronic work disability (50% prevalence).[3 4 29] This may be due to increasing cumulative risk of a new onset depression disorder with disability duration, and the bidirectional disability–depression relationship.[30] Meanwhile, the prevalence of post-injury anxiety disorders for men in the current study (12% for men) was similar to studies of injured men and women workers with chronic work disability (11%).[1 2]

In Canada, approximately 9% of men and 16% of women between 20 and 65 years of age have at least one physician visit or hospitalisation with a diagnosis of anxiety or depression annually.[31] Estimates from the current study were much higher, especially for women (13%–15% of men and 29%–31% of women). This suggests that in both the year before and the year after injury, workers with musculoskeletal strain or sprain work injury have an elevated prevalence of anxiety and depression disorders compared with the general population.

Risk factors for prevalent and new onset disorders

The finding that anxiety and depression are part of a complex health profile is consistent with the literature on general populations and clinical study samples.[32] Findings for the prior claims variable may be due to a bidirectional relationship between work injury and mental disorders, whereby one leads to another, and vice versa. This is supported by the literature on depression and pain conditions, where depression is both a cause and a consequence of pain,[7] as well as evidence that if you have a prior claim you are more likely to incur another.[33] Another possible explanation is that workers with multiple claims have greater exposure to risks at work, and that this may lead to mental disorders when returning to the same working environment after injury. Lastly, findings for the variable indicating a secondary diagnosis on the injury claim suggest that multisite injuries, which may be more complicated or severe, are a risk factor for anxiety and depression.

Differences between men and women

In general, the study findings indicate gender-based or sex-based differences in the risk factors for mental health outcomes in a work disability context. These differences varied whether for anxiety, depression or comorbid anxiety and depression, but included rural versus urban living, having dependents in the home, type of occupation and size of employer. Further, while women were more likely to have

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Table 4 Adjusted[a] OR with 95% CI for risk factors of new onset medically treated anxiety and depression disorders in the 3 months after injury, multinomial logistic regression

	Men			Women		
	Anxiety only	Depression only	Anxiety and depression	Anxiety only	Depression only	Anxiety and depression
Sociodemographic						
Age group (years)						
19–24	1	1	1	1	1	1
25–29	1.32 (1.02–1.70)	0.95 (0.68–1.33)	1.51 (1.14–2.00)	1.15 (0.88–1.50)	0.84 (0.58–1.21)	0.99 (0.73–1.34)
30–39	1.30 (1.03–1.64)	1.13 (0.85–1.51)	1.35 (1.04–1.75)	1.02 (0.80–1.30)	0.94 (0.68–1.29)	0.95 (0.72–1.24)
40–49	1.29 (1.02–1.63)	0.73 (0.53–0.99)	1.08 (0.82–1.41)	0.93 (0.74–1.18)	0.65 (0.47–0.89)	0.76 (0.58–0.99)
50–59	1.14 (0.89–1.45)	0.55 (0.39–0.76)	0.96 (0.73–1.28)	0.91 (0.71–1.16)	0.51 (0.37–0.71)	0.66 (0.50–0.87)
60–64	0.99 (0.70–1.40)	0.60 (0.36–1.00)	0.55 (0.33–0.90)	0.56 (0.36–0.85)	0.38 (0.20–0.71)	0.71 (0.47–1.07)
Income quintile						
1: lowest	1	1	1	1	1	1
2	1.06 (0.87–1.31)	0.90 (0.68–1.20)	1.03 (0.82–1.30)	1.06 (0.91–1.23)	0.96 (0.77–1.20)	1.10 (0.92–1.32)
3	0.96 (0.78–1.19)	0.88 (0.66–1.17)	0.88 (0.69–1.11)	0.83 (0.70–0.99)	0.68 (0.53–0.88)	0.98 (0.81–1.20)
4	1.05 (0.86–1.28)	0.86 (0.65–1.14)	0.91 (0.72–1.14)	0.95 (0.78–1.15)	0.78 (0.58–1.04)	0.87 (0.68–1.10)
5: highest	0.94 (0.76–1.15)	0.83 (0.62–1.11)	0.74 (0.58–0.94)	0.79 (0.63–0.99)	0.45 (0.30–0.67)	0.78 (0.59–1.03)
Dependents						
0	1	1	1	1	1	1
1 or more	0.97 (0.86–1.10)	1.00 (0.84–1.20)	1.10 (0.95–1.26)	1.25 (1.11–1.42)	1.00 (0.83–1.20)	0.96 (0.83–1.12)
Location						
Urban	1	1	1	1	1	1
Rural	0.89 (0.73–1.09)	1.13 (0.87–1.47)	0.95 (0.76–1.20)	1.17 (0.98–1.38)	1.30 (1.01–1.67)	0.89 (0.71–1.11)
Injury						
Injured body part						
Sacroiliac	1	1	1	1	1	1
Back/neck	1.16 (0.98–1.37)	1.22 (0.95–1.57)	0.92 (0.77–1.10)	1.19 (1.00–1.43)	1.06 (0.82–1.37)	0.99 (0.81–1.21)
Upper limb	1.11 (0.92–1.33)	1.21 (0.92–1.60)	0.70 (0.57–0.87)	1.15 (0.95–1.40)	0.87 (0.66–1.16)	0.92 (0.74–1.14)
Incident type						
Exertion	1	1	1	1	1	1
Traumatic	1.32 (0.90–1.93)	1.19 (0.66–2.15)	1.67 (1.09–2.55)	1.53 (1.20–1.94)	1.33 (0.88–2.00)	1.32 (0.97–1.79)
Fall/slip/trip	1.00 (0.85–1.17)	1.14 (0.91–1.43)	1.07 (0.89–1.29)	0.99 (0.84–1.16)	1.12 (0.88–1.41)	1.11 (0.92–1.32)
Contact object	1.05 (0.83–1.34)	0.98 (0.69–1.39)	1.23 (0.94–1.60)	1.11 (0.88–1.38)	0.98 (0.68–1.41)	0.87 (0.65–1.16)
Transportation	1.64 (1.35–1.99)	1.30 (0.96–1.77)	1.65 (1.31–2.08)	1.54 (1.18–2.01)	0.66 (0.37–1.17)	1.35 (0.97–1.87)
Bodily motion	1.01 (0.86–1.18)	0.95 (0.76–1.20)	0.80 (0.66–0.98)	0.97 (0.83–1.12)	1.21 (0.98–1.50)	0.69 (0.56–0.83)
Secondary claim diagnosis						
No	1	1	1	1	1	1
Yes*	1.26 (1.09–1.45)	1.27 (1.03–1.58)	1.18 (0.99–1.40)	1.24 (1.09–1.41)	1.17 (0.96–1.43)	1.15 (0.98–1.34)
Clinical						
Somatic comorbidity						
0	1	1	1	1	1	1
1	1.30 (1.02–1.67)	1.19 (0.84–1.67)	1.25 (0.94–1.67)	1.19 (0.82–1.72)	0.76 (0.46–1.25)	1.09 (0.71–1.68)
2	1.51 (1.19–1.92)	1.34 (0.96–1.87)	1.31 (0.99–1.74)	1.39 (0.98–1.98)	1.19 (0.76–1.88)	1.30 (0.87–1.96)
3	1.68 (1.31–2.14)	1.54 (1.10–2.15)	1.66 (1.25–2.20)	1.71 (1.21–2.41)	1.05 (0.67–1.65)	1.59 (1.07–2.37)
4	2.19 (1.70–2.81)	1.74 (1.22–2.49)	2.01 (1.50–2.70)	1.84 (1.30–2.61)	1.24 (0.79–1.95)	1.59 (1.06–2.38)
5 or more	2.74 (2.13–3.51)	2.08 (1.46–2.97)	2.37 (1.77–3.17)	2.10 (1.49–2.96)	1.29 (0.83–2.01)	1.87 (1.26–2.77)
Mental comorbidity						
0	1	1	1	1	1	1
1 or more*	1.54 (1.18–2.00)	1.79 (1.25–2.58)	1.64 (1.22–2.21)	1.31 (0.94–1.83)	1.40 (0.86–2.28)	1.36 (0.92–2.01)
Prior claims						
0	1	1	1	1	1	1
1	0.91 (0.78–1.06)	1.09 (0.88–1.36)	1.00 (0.84–1.20)	1.09 (0.95–1.25)	1.00 (0.81–1.24)	0.96 (0.81–1.13)
2	1.00 (0.85–1.19)	1.09 (0.85–1.39)	1.03 (0.85–1.26)	1.26 (1.08–1.49)	1.01 (0.77–1.32)	1.06 (0.87–1.29)
3 or more	1.01 (0.87–1.17)	1.09 (0.87–1.37)	1.13 (0.95–1.35)	1.04 (0.88–1.22)	1.35 (1.06–1.71)	1.10 (0.91–1.33)
Prior anxiety or depression						
None	1	1	1	1	1	1

continued

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Table 4 continued

	Men			Women		
	Anxiety only	Depression only	Anxiety and depression	Anxiety only	Depression only	Anxiety and depression
Anxiety only	2.47 (2.11–2.89)	1.72 (1.3–2.27)	1.84 (1.48–2.29)	2.37 (2.02–2.78)	1.67 (1.26–2.21)	1.21 (0.95–1.55)
Depression only	1.72 (1.34–2.20)	3.75 (2.86–4.9)	2.10 (1.59–2.77)	1.37 (1.05–1.78)	3.37 (2.51–4.51)	1.60 (1.17–2.18)
Anxiety and depression	2.54 (2.23–2.90)	3.02 (2.5–3.65)	3.67 (3.17–4.24)	2.38 (2.08–2.71)	2.70 (2.21–3.30)	3.35 (2.87–3.90)
Work						
Firm size						
30 or less	1	1	1	1	1	1
31–150	0.99 (0.92–1.06)	1.00 (0.93–1.09)	1.01 (0.96–1.07)	0.93 (0.86–1.00)	0.91 (0.83–0.99)	0.93 (0.88–0.98)
151–1000	1.06 (0.99–1.14)	1.02 (0.94–1.11)	1.07 (1.01–1.13)	0.86 (0.80–0.93)	0.81 (0.74–0.88)	0.83 (0.79–0.88)
1001 to 10 000	1.18 (1.09–1.28)	1.10 (1.00–1.21)	1.18 (1.11–1.26)	0.97 (0.90–1.04)	0.94 (0.86–1.03)	0.99 (0.93–1.05)
10 001 or more	1.22 (1.03–1.44)	1.21 (0.99–1.48)	1.29 (1.13–1.48)	0.94 (0.87–1.03)	1.02 (0.92–1.13)	1.07 (1.00–1.14)
Shift type						
Fixed	1	1	1	1	1	1
Not fixed	1.05 (0.91–1.21)	1.09 (0.88–1.34)	1.03 (0.87–1.22)	1.16 (1.03–1.32)	0.82 (0.67–1.00)	0.91 (0.78–1.06)
Occupation						
Sales and services	1	1	1	1	1	1
Art, culture, recreation, sport	0.83 (0.42–1.62)	1.71 (0.82–3.54)	0.42 (0.13–1.32)	0.83 (0.49–1.40)	0.55 (0.23–1.35)	0.88 (0.49–1.57)
Business, finance, administration	0.69 (0.51–0.94)	0.55 (0.32–0.93)	0.66 (0.45–0.96)	1.28 (1.01–1.61)	1.13 (0.80–1.61)	0.93 (0.69–1.24)
Health	1.08 (0.79–1.47)	1.51 (0.97–2.34)	0.97 (0.64–1.45)	1.09 (0.93–1.29)	1.03 (0.80–1.32)	1.13 (0.93–1.37)
Management	0.83 (0.52–1.34)	0.94 (0.45–1.95)	0.93 (0.53–1.66)	0.71 (0.45–1.12)	0.78 (0.41–1.48)	0.93 (0.59–1.47)
Natural and applied sciences	1.17 (0.82–1.67)	1.16 (0.66–2.03)	0.60 (0.33–1.09)	0.51 (0.19–1.38)	0.61 (0.15–2.46)	0.33 (0.08–1.33)
Primary industry	0.79 (0.57–1.11)	0.68 (0.40–1.16)	0.71 (0.46–1.08)	0.90 (0.56–1.46)	0.61 (0.27–1.38)	0.83 (0.47–1.45)
Processing, manufacturing, utilities	0.81 (0.65–1.01)	0.96 (0.69–1.32)	1.15 (0.90–1.47)	1.13 (0.88–1.46)	1.06 (0.73–1.54)	1.08 (0.80–1.45)
Social science, education, government	1.31 (0.86–2.00)	0.84 (0.36–1.93)	1.03 (0.58–1.83)	1.35 (1.09–1.68)	1.38 (1.00–1.90)	0.97 (0.73–1.28)
Trades, transport, equipment operators	0.82 (0.70–0.97)	0.99 (0.77–1.28)	0.97 (0.80–1.18)	0.92 (0.72–1.18)	0.94 (0.65–1.35)	0.89 (0.67–1.19)

*Anxiety and depression not included.

prevalent and new onset anxiety and depression outcomes, other clinical risk factors were more strongly associated with these outcomes in men. Mechanisms that may contribute to these gendered findings include greater economic reliance on industries characterised by patriarchal male dominant values and practices in rural compared with urban areas,[34] greater psychological strain due to childcare in working mothers than fathers,[35] and more opportunities for mental health support among working women than men,[36] resulting in a protective effect for women, particularly during more vulnerable circumstances like when other health comorbidities are present. Lastly, firm size was likely a surrogate measure for working conditions and environments, but it remains unclear what underlying gender-based or sex-based effect this measure captured for men. Taken together, the results suggest that context matters, that men and women experience it differently, and taking contextual factors into consideration may be important to successful case management for work disability.

Strengths and limitations

The major strengths of this study include a population-based sample of all compensated lost-time injury for spine or upper limb strain or sprain in British Columbia from 2000 to 2013, and comprehensive longitudinal health claims data. Despite this, there are some potential limitations. First, anxiety and depression disorders are underdiagnosed and undertreated in Canada in general, but more so for men than for women.[37–39] To a similar effect, mental services from a counsellor or psychologist were not included in the case definitions including those paid for out of pocket, by private health insurance or by WorkSafeBC. These limitations could exert a conservative bias on the men's and women's findings accordingly. Second, exact mapping of the ICD-9 and ICD-10-CA systems was not possible due to differences in the systems and use of three digit ICD-9 codes in the physician billing data. However, the most commonly occurring anxiety and depression disorders were consistently captured and classified by both systems and discrepancies in the subcodes were limited to infrequently occurring conditions. Further, hospitalisations were infrequent in the study sample with only one hospital diagnosis (ICD-10-CA) identified for every 100 in the physician billing data (ICD-9). Given this, discrepancies in the ICD-9 and ICD-10-CA systems would have negligible impact on the findings. Third, antidepressants and diagnostic code 50b for anxiety/depression were included in both the anxiety and the depression case definitions. To account for the low specificity of these healthcare events, the case definitions required appropriate secondary validation events to rule them in as anxiety alone, depression alone, or comorbid anxiety and depression. The ratio of individual anxiety and depression disorders (alone) to comorbid anxiety and depression disorders in the current study was similar to other studies of primary care patients,[40] suggesting suitability of these classification decisions. However, there likely remains some misclassification between the case groups. Lastly, the findings may not be externally generalisable to work injuries that are uncompensated or typically characterised by a longer term disability prognosis.

CONCLUSION AND IMPLICATIONS

The current findings suggest that workers with an anxiety or depression disorder are a large enough subpopulation to warrant attention at a policy level. In addition to new onset conditions

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attributable to the injury, pre-existing anxiety and depression disorders are also important considerations for injured workers' mental health. Healthcare professionals and policy makers should consider that workers with an anxiety or depression disorder in addition to musculoskeletal strain or sprain injury are more likely to be women and to have a more complicated clinical profile including a greater number of mental and somatic comorbidities. Inclusion of gender-sensitive and sex-sensitive mental healthcare is an important consideration for work disability management.

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