



Bachelor of Science in Medicine Degree Program  
End of Term Final Report

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**Project Title:** An Examination of Chronic Pain Conditions and Mental Health Correlates in a Population-Based Survey of Canadian Forces Personnel

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**Summary (250 words max single spaced):**

**Introduction:** Chronic pain conditions and mental disorders are highly prevalent in military and veteran populations. Despite this, few investigations have been conducted examining the co-morbidity between chronic pain conditions and specific mental disorders.

**Methods:** Data were analyzed from the 2013 Canadian Forces Mental Health Survey (CFMHS) using the regular member population (n = 6696). Diagnostic interviews assessed mental disorders and participants self-reported chronic pain conditions (i.e., arthritis, back problems, musculoskeletal conditions, migraines and traumatic brain injury (TBI)/concussion) and indicators of pain severity. Multivariate logistic regression models assessed associations between the chronic pain conditions and mental disorders. Weighted cross-tabulations and moderation analyses assessed the prevalence of pain severity indicators in comorbid relationships compared to the physical condition alone.

**Results:** 25% of participants endorsed chronic pain. In the most stringent model that additionally adjusted for comorbid mental disorders, all assessed chronic pain conditions were significantly associated with PTSD (odds ratio range (ORR): 1.86-3.57,  $p < 0.01$ ). Further, back problems remained significantly associated with all mental disorders apart from AUD (ORR: 1.40-2.17,  $p < 0.05$ ). Cross-tabulations demonstrated greater pain severity indicators among those with mental disorders and comorbid physical conditions, compared to physical conditions alone. Formal moderation analyses showed a significant relationship between migraine and activity limitation on PTSD.

**Interpretation:** Chronic pain conditions are prevalent and co-occur with mental disorders among Canadian regular force members. Results are particularly robust for PTSD and suggest that comorbidity with migraines, in particular, results in greater activity limitations than migraine alone.

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## Introduction

Previous research indicates that military personnel experience a high prevalence of chronic pain, chronic physical conditions, and mental disorders. In the Canadian general population (CGP), chronic pain estimates vary from 15.3-19.5%<sup>1,2,3</sup>, whereas chronic pain estimates in the Canadian Armed Forces (CAF) are estimated around 41%<sup>4</sup>. Estimates of physical health conditions are similar, with Regular Forces Canadian veterans having higher prevalence rates of arthritis, back pain and bowel disorders than CGP<sup>5</sup>. Military personnel also have high estimates of mental health conditions. In 2002, the Canadian Community Health Survey Canadian Forces Supplement (CCHS-CF) reported high prevalence rates of depression, panic disorder and suicidal thoughts in the Regular members of the Canadian Forces<sup>6</sup>. These high prevalence rates of mental disorders among military personnel are corroborated in more recent literature. Specifically, research indicates that in the Canadian Survey on Transition to Civilian Life conducted in 2010 – 8 years after the 2002 CCHS – the prevalence of generalized anxiety disorder (GAD) was two times higher in the CAF compared to the CGP<sup>5</sup>. In light of this burden, the current study aims to investigate the relationships between mental disorders, chronic pain severity, and physical conditions among Canadian military personnel.

There is growing interest in the relationship between mental disorders and physical conditions. General population-based studies have found strong relationships between chronic physical conditions and depression<sup>7,8,9,10,11</sup>, anxiety disorders<sup>12,13,14</sup>, posttraumatic stress disorder (PTSD)<sup>15,16</sup> among other mental disorders<sup>17</sup>. A major limitation with these studies is the lack of research looking at *specific* mental disorders, such as GAD; extant research examining comorbid relationships has primarily examined summary disorder categories instead of individual disorders<sup>12,14,18–20</sup> due to limited statistical power. Another limitation pertains to the lack of research examining chronic pain severity as a potential mechanism or differentiating factor for these comorbid relationships. Chronic pain severity is important to investigate when examining comorbid relationships between physical conditions and mental disorders to elucidate potential mechanisms. Doing so extends the comorbidity investigation and provides a better understanding of the role mental disorders have on pain severity and activity limitations among those with physical conditions. There are even greater gaps in extant literature when looking at the co-morbidity research within the military context specifically. First, military population research has primarily been focused on PTSD and its relationship with physical conditions<sup>15,16,21</sup>. Second, there is limited research within the Canadian military context regarding these comorbidities, particularly compared to the number of United States (US) studies. Although the US and Canadian military populations both have elevated prevalence rates of mental disorders and physical conditions, these two military populations vary in military experiences, access to health care<sup>22</sup> as well as recruitment and deployment policies<sup>23</sup>. The current study addresses many of the limitations by assessing several specific mental disorders (including GAD and panic disorder) and physical conditions in a contemporary active Canadian military sample. With over 40,000 Canadian Force members having been deployed to Afghanistan since 2001, military personnel should be a focus for Canadian military research<sup>24</sup>.

The specific objectives of the current study are to: (1) compute prevalence rates of chronic pain and physical conditions characterized by pain symptomatology among Canadian military personnel, (2) examine the association between physical conditions and mental disorders, and (3) assess prevalence rates of pain severity indicators among personnel with comorbid mental disorders and physical conditions compared to those with physical conditions alone.

## Method

### Data source and study population

The data were drawn from the cross-sectional 2013 Canadian Forces Mental Health Survey (CFMHS) conducted by Statistics Canada that includes 6,696 regular Canadian Force members (response rate = 79.8%<sup>25</sup>). Interviewers surveyed respondents face-to-face using a computer-assisted interviewing technique. Consent was given prior to the conduction of the survey. Data collection was completed from April 15 to August 31, 2013<sup>26</sup>. Ethical approval to conduct the survey was obtained through the relevant bodies within Statistics Canada<sup>25</sup>.

The CFMHS sample consisted of both regular and reservist members, however we only included regular members in this study as the reservist members sampled were not a representative sample. Statistics Canada conducted a systematic sampling approach to ensure that regular members were nationally representative<sup>26</sup>.

### Primary Variables

*Mental Disorders.* Past-year mental disorders were assessed using criteria from the World Health Organization version of the Composite International Diagnostic Interview (WHO-CIDI) based on Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) and the 10<sup>th</sup> revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) criteria. Mental disorders included in the analyses are major depressive episode (MDE), GAD, panic disorder, PTSD and alcohol use disorder (AUD). Research has shown concordance between the WHO-CIDI and Structured Clinical Interviews for DSM-IV (SCID)<sup>27</sup>.

*Physical Conditions.* Chronic physical conditions were characterized by pain symptoms. These physical conditions were expected to have lasted 6 months and were based on self-report of being diagnosed by a health professional. Physical conditions included arthritis; back problems; other musculoskeletal (MSK) problems/fibromyalgia; migraine headaches; and traumatic brain injury (TBI) or concussion.

*Chronic Pain Characteristics.* The presence of chronic pain was defined in terms of endorsing usual 'pain or discomfort', regardless of location, and was based on self-report. Pain was further characterized by severity and the number of activities prevented. Pain severity was assessed by a description of the usual intensity of their pain or discomfort: 'mild', 'moderate' or 'severe'. In terms of activity prevention, the respondent was able to select from four options (none, a few, some, most) to describe the number of activities prevented due to pain or discomfort. We created the following categorizations based on responses: 'no pain and mild pain' or 'moderate and severe pain' for pain severity, and 'no pain, none or a few' activities prevented or 'some to most' activities prevented following a sensitivity analysis. These variables were collapsed to ensure adequate statistical power.

*Sociodemographic and military variables.* Sociodemographic variables include age (assessed continuously), sex, marital status (married or common-law; separated, divorced or widowed; single, never married), education level (high school or less; some postsecondary; trade, college, or university certificate or diploma; university degree), household income ( $\leq 29,999$ ; 30,000-49,999; 50,000-79,999;  $\geq 80,000$ ), and ethnicity (white, other). Military-related variables include rank (junior noncommissioned member, senior noncommissioned member, officer) and Canadian Force type (army, navy, air force). Marital status and income were categorized in accordance with other literature using the CFMHS<sup>28</sup> and education level, ethnicity and military rank were derived variables created by Statistics Canada.

### Analytical Strategy

Weighted n's and percentage frequencies of the primary variables were established. We conducted cross-tabulations to derive weighted frequencies for (1) presence of pain among each physical condition and (2) the presence of individual mental disorders (i.e., MDE, GAD, panic disorder, PTSD, AUD) among each physical condition. Bivariate and multivariate logistic regression models assessed the relationship between the physical conditions (independent variable) and each mental disorder (dependent variable). The multivariate models adjusted for (1) sociodemographic factors (age, sex, marital status, education level, income, ethnicity, rank, Canadian Force type), and (2) sociodemographic factors and mental disorders (excluding the disorder of interest).

To examine the impact of pain severity in comorbid relationships, we used cross-tabulations to examine the proportion of individuals who endorsed severe vs. mild pain indicators (severity and impact), with and without the mental disorder of interest, among those with each physical condition. This was conducted only among the chronic physical conditions that were significantly associated with mental disorders in the most stringent model in the logistic regressions assessing comorbidity. Finally, we conducted a moderation analysis where two different interaction terms were used: physical condition by pain severity and physical condition by activity limitation, respectively, and their association with significant mental disorders. Analyses were weighted so that results are representative of the CAF Regular Force population and a bootstrapping technique was applied for

variance estimation to account for the complex survey design. Data were weighted and rounded to base 20 according to Statistics Canada policies for this dataset for the primary variables of interest. All analyses were conducted in STATA software<sup>29</sup>.

## Results

### Sample Description

Table 1 includes the sample size and weighted prevalence rates of the sociodemographic and military factors among Regular Force members. The mean age was 35 years old and the majority of the sample were male (86.1%). Army was the most prevalent CAF type in the sample (53.1%), and junior non-commissioned member was the most prevalent rank (55.0%). Approximately one quarter of the entire sample indicated usual pain or discomfort (25.5%), and of those individuals, over 60% deemed their pain to be moderate to severe. Other MSK problems/fibromyalgia was the most prevalent physical condition group (30.5%).

Not listed in Table 1, cross-tabulations were also conducted looking at presence of usual pain among each physical condition. Of those with arthritis, 70.1% endorsed usual pain, followed by back problems (57.8%), TBI or concussion (52.0%), other MSK problems/fibromyalgia (51.5%) and migraine (47.3%).

### Comorbidity Findings

Table 2 displays the prevalence of mental disorders among each chronic physical condition. All physical conditions were significantly associated with MDE, GAD, panic disorder and PTSD in both the unadjusted model and the adjusted model accounting for sociodemographic variables (MDE Odds Ratio Range (ORR): 1.51-2.96; GAD ORR: 1.73-3.43; Panic Disorder ORR: 2.37-3.62, PTSD ORR: 2.09-5.08). Once adjusting for other mental disorders, only the associations between PTSD and all physical conditions remained significant (PTSD ORR: 1.86-3.57), while many of the associations between physical health conditions and MDE, GAD and panic disorder were no longer significant. No significant relationships were seen between AUD and physical health conditions in the most stringent model.

### Pain Severity Analyses

Weighted cross-tabulations indicated that among physical conditions larger proportions of severe pain endorsement was seen in those with the mental disorder of interest compared to those without (see Table 3). Similar results were seen with regard to activity limitation, with higher proportions of greater activity limitation seen in those with the mental disorder compared to those without. Formal interaction analyses showed a significant relationship between migraine and activity limitation on PTSD (Odds Ratio (OR): .639, 95% CI: .430-.950,  $p < 0.05$ ), which corresponds with a prevalence of 24% of those without PTSD endorsing some to most activities prevented compared to 48% of those with PTSD endorse some to most activities prevented among those with migraine. No other interaction analyses were significant.

## Discussion

This was the first population-based investigation examining comorbidities of physical conditions characterized by chronic pain and a broad range of mental disorders within the active Regular Force members of the CAF. The novel findings from this study include that (1) 25% of the sample experience regular chronic pain; (2) physical conditions and mental disorders are comorbid but the strength of the association varies depending on the mental disorder of interest, with particularly robust findings for PTSD; and (3) among those with a physical condition, trends emerged suggesting that higher prevalences of pain severity indicators – in terms of both severity and impact on functioning – are seen in those with a comorbid mental disorder compared to those without.

### Chronic Pain and Physical Conditions

High prevalence estimates of chronic pain among CAF *veterans* has been documented, with reports being as high as 41%<sup>4</sup>. The current study shows that chronic pain is also common among

active CAF members, with one quarter of the sample endorsing chronic pain. Furthermore, the majority of those who endorsed chronic pain indicated their pain is moderate to severe, and 75% of those with chronic pain reported some impact on functioning. Our results further reveal high rates of physical conditions among Regular force personnel. Over one third of the study's population indicated having MSK problems or fibromyalgia, followed by back problems (23.3%) and arthritis (12.4%). Increased physical work demands required of active CAF members may explain increased rates of chronic pain and physical conditions. Military work can often be unpredictable and demanding<sup>30</sup> which can lead to injury. Patel et al. (2017) found that non-battle injury rates were high in a sample of deployed US Army soldiers, and the two most common causes were 'sports/physical training' and 'falls/jumps'<sup>31</sup>. The most common injury types were fractures, overuse pain and inflammation, and dislocations<sup>31</sup>. In addition, militants are enduring more poly-traumatic injuries compared to the past<sup>32</sup>. Given the high rates of injury, the physical conditions assessed could be sequelae of past injuries, supported by the fact that injury-induced arthritis<sup>33</sup> and injury-related disc degeneration<sup>34</sup> does occur. Moreover, migraines, TBI and back problems can all be related to injury as well<sup>35,36</sup>. Thus, these prevalent physical conditions characterized by pain may be partly related to the sample's unique position of having an occupation which requires intense physical demands.

### Co-morbidity Patterns

Among military personnel, two unique co-morbidity trends appeared: the first being non-significant relationships between physical conditions and AUD, and the second being the robust findings related to PTSD.

Alcohol use is associated with chronic physiologic diseases<sup>37</sup>, though little research has been conducted examining comorbidity patterns between AUD and physical conditions largely characterized by pain. One reason for the lack of significant relationships in our study could be due to the nature of the sample, and that AUD – a disorder that greatly impacts functioning – may be found less in a population who are capable of working as active militants. This may be likely, given the prevalence of AUD is lower in the Regular Force population compared to the CGP<sup>38</sup>. This may be particularly true for personnel with chronic health conditions where the combination may result in an inability to work.

Strong associations were found between PTSD and all the assessed physical conditions, even in the most stringent model. These trends parallel those seen in the CGP<sup>39</sup>. In the current sample, associations between TBI or concussion and PTSD were most prominent (OR: 3.57, 95% CI: 2.02-6.03,  $p < 0.001$ ) which is unique to the military population according to previous literature<sup>40</sup>. A likely explanation for this relates to combat exposure being significantly predictive of PTSD<sup>41</sup>. Combat-related trauma fosters the potential for TBI development<sup>42</sup> and therefore, this uniquely robust association may be due to the same shared determinant of combat exposure.

The significant relationships between PTSD and the other physical conditions may be bidirectional. First, PTSD may be predictive of a physical condition through its symptomatology profile or through a secondary mechanism such as maladaptive behavior. For example, sleep disturbance is a key feature of alterations of arousal and reactivity in PTSD<sup>43</sup>, and poor quality of sleep has been significantly associated with physical illness<sup>44-48</sup>. With previous reports of veterans experiencing poor quality of sleep<sup>49</sup>, sleep disturbance in PTSD may be a propagating factor for these comorbidities. With respect to maladaptive behaviours, research has shown that escape-avoidance behaviors (represented as drinking, smoking, etc.) are methods of coping after one has experienced a trauma<sup>50,51</sup>, which are associated with many health conditions<sup>52,53,54,55,56</sup>. Deployment may prompt maladaptive behaviors to cope<sup>57</sup>, which is corroborated by increased incidence in smoking in deployed compared to non-deployed personnel<sup>58</sup>. Additional possible mechanisms may include physiological indicators (e.g., increases in proinflammatory cytokines) or genetic factors<sup>59</sup> mediating the relationship between PTSD and physical health conditions. Considering the reverse, physical conditions might contribute to the development of PTSD as the physical condition itself may be the trauma eliciting the PTSD. This is supported by Edmondson's Enduring Somatic Threat (EST) model, which provides explanation for the negative psychological and behavioral consequences following an acute, life-threatening illness<sup>60</sup>. The EST model argues that PTSD due to an acute medical illness is different than PTSD caused by another (non-medical) event<sup>60</sup>. A critical difference between these two types of PTSD is the nature of the traumatic event (a medical event is internal

and enduring in its symptoms, while a traditional traumatic event is both external and a discrete event in the past) leading to differing PTSD symptoms<sup>60</sup>. Although Edmondson proposed the EST model for acute-illness events, it is possible that it could be applied to chronic physical conditions as well. Edmondson notes that patients often feel a lack of control when focusing on possible future acute events and the associated negative functional outcomes<sup>60</sup>. Migraines, for example – though not life-threatening – draw several parallels with these acute illnesses; they can be acute and unpredictable<sup>61</sup> and can be severely debilitating greatly impacting functioning<sup>61</sup>.

Several physical conditions were no longer significantly associated with mental disorders when additionally controlling for other mental disorders. This might suggest that multiple mental comorbidities lead to an increased expression of physical conditions. Supporting research shows that comorbid anxiety and depression is associated with higher rates of chronic conditions, compared to having no mental disorder or the presence of only one mental disorder<sup>18,62</sup>. Additionally, back problems remained significant with most mental disorders in the most stringent model. This may be due to the lack of specific criteria relative to the other physical conditions, allowing people to endorse their back pain as 'back problems' within the survey. Further, the psychosomatic features of back pain may also contribute to the robust associations found<sup>63</sup>.

### **Pain Severity Indicators**

The cross-tabulations demonstrated a consistent trend in those with a physical condition whereby greater proportions of more severe pain indicators were seen in those with a comorbid mental disorder compared to those without. This trend was again particularly robust for PTSD. Further, in addition to the significant relationship of migraine and activity limitation leading to PTSD, several relationships trended towards significance ( $p < .1$ ), including migraine and pain severity leading to MDE ( $p = 0.066$ ), migraine and pain severity leading to PTSD ( $p = 0.089$ ) and back problems and pain limitations leading to panic disorder ( $p = 0.074$ ). These relationships further support the impact of mental disorders on pain severity indicators. These results are not surprising, as comorbidity between mental disorders and medical illness in general population samples have been associated with increased functional disability<sup>8</sup> and pain severity<sup>64,65</sup> compared to having the physical condition alone.

Regarding the robust associations with PTSD, Otis supports a possible explanation on the premise that PTSD and chronic pain both have unpredictable and uncontrollable symptoms<sup>66</sup>. This shared factor may contribute to their simultaneous development<sup>66</sup>, and perhaps also worsen symptoms synergistically. This speculation is supported by research showing individuals with PTSD exhibit higher rates and more intense chronic pain compared to those without PTSD, and that severity of PTSD symptoms correlates with chronic pain severity<sup>67</sup>.

### **Limitations**

These novel findings must be considered in light of several limitations to this study. First, the cross-sectional survey design of the CFMHS makes it difficult to assess causation of these comorbid relationships. Second, the self-reported physical conditions may result in biased estimates, especially with regard to the physical conditions that were inadequately defined (e.g. back problems, other MSK problems). However, research has demonstrated a high concordance between self-reported physical conditions and physician diagnosed conditions<sup>68</sup>. Third, focusing our study on the Regular Force sample only narrows generalizability to all Regular Force members of the CAF. Fourth, with the majority of the sample being male our findings may be less generalizable to female military personnel. Finally, due to Statistics Canada policy regarding military data we were unable to report more specific  $n$  in our descriptive statistics; however, weighted prevalence rates were representative.

### **Conclusion**

This study demonstrates that Regular Force personnel have a high prevalence of physical conditions, and a significant proportion experience regular pain. Further, there is a high comorbidity between physical conditions and mental disorders, particularly PTSD. Emphasis on mental disorder screening (especially in the context of chronic physical conditions), and encouraging prompt

management of chronic physical conditions are implications that can be integrated into the primary care setting of the CAF. In addition, the recognition of multimorbidity and its effects on disease severity and outcome is critical in the primary care setting. Prompt recognition of mental disorders is paramount despite the challenges health care providers face in recognizing comorbid mental disorders in the context of physical illness<sup>69</sup> and the socio-cultural practice of downplaying mental health conditions<sup>57,70</sup>, which may be particularly apparent in active military personnel. Longitudinal research examining the development of comorbid mental and physical conditions within this population, as well as research looking into the impact of targeted interventions should be a priority. This study reveals pertinent information regarding comorbidities and chronic pain that is underrepresented in the literature.

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<b>Table 1. Primary sample characteristics (N = 6696)</b>	
	Weighted N (weighted %)
<b>Age (mean, SE)</b>	35.4 (.105)
<b>Canadian Force Type</b>	
Navy	11080 (17.2)
Army	34220 (53.1)
Air Force	19100 (29.7)
<b>Canadian Force Rank</b>	
Junior Non-Commissioned Member	35440 (55)
Senior Non-Commissioned Member	15500 (24.1)
Officer	13460 (20.9)
<b>Sex</b>	
Male	55480 (86.1)
Female	8920 (13.9)
<b>Ethnic Minority</b>	
No	57900 (90.1)
Yes	6360 (9.9)
<b>Marital Status</b>	
Married or common-law	42200 (65.6)
Widowed, separated or divorced	4840 (7.5)
Single, never married	17300 (26.9)
<b>Income</b>	
Less or equal to \$29,999	1060 (1.6)
\$30,000-49,999	3160 (4.9)
\$50,000-79,999	18740 (29.1)
Equal or greater than \$80,000	41440 (64.3)
<b>Education</b>	
Less than secondary school graduation	2620 (4.1)
Secondary school graduation	16540 (25.7)
Some post-secondary	5700 (8.9)
Post-secondary graduation	39400 (61.3)
<b>Chronic Physical Conditions</b>	
Fibromyalgia and musculoskeletal problems	19600 (30.5)
Arthritis	7680 (12.4)
Back problems	14980 (23.3)
Migraine	5880 (9.1)
Traumatic brain injury or concussion	1960 (3.1)
<b>Past-Year Mental Disorders</b>	
Major depressive episode	5120 (8)
Generalized anxiety disorder	3000 (4.7)
Panic Disorder	2140 (3.4)
Post-traumatic stress disorder	3340 (5.3)
Alcohol use disorder	2880 (4.5)

*Note.* Numbers are weighted and rounded to base 20, and percentages are based on rounded frequencies.

**Table 2.** Individual logistic regressions analyzing the relationships between physical conditions and past-year mental disorders among Canadian Forces Personnel

Physical Conditions	Mental Disorders									
	MDE		GAD		Panic Disorder		PTSD		AUD	
	Weighted N (weighted %)*									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>MSK Problems</b>	2380 (12.2)	2740 (6.1)	1340 (6.9)	1660 (3.7)	1100 (5.7)	1040 (2.4)	1740 (9)	1600 (3.6)	880 (4.5)	2020 (4.5)
	Odds Ratios (95% CI)									
UOR	2.13 (1.74-2.61)***		1.92 (1.50-2.49)***		2.52 (1.87-3.39)***		2.68 (2.11-3.40)***		.990 (.73-1.34)	
AOR1	2.12 (1.73-2.61)***		1.78 (1.37-2.32)***		2.37 (1.75-3.21)***		2.47 (1.92-3.17)***		1.36 (.99-1.86)	
AOR2	1.80 (1.42-2.29)***		1.04 (.74-1.45)		1.75 (1.23-2.49)**		1.88 (1.42-2.50)***		1.04 (.73-1.48)	
	Weighted N (weighted %)*									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>Arthritis</b>	880 (11.5)	4220 (7.5)	620 (8.2)	2380 (4.2)	560 (7.5)	1580 (2.8)	780 (10.4)	2560 (4.6)	280 (3.7)	2600 (4.6)
	Odds Ratios (95% CI)									
UOR	1.61 (1.24-2.08)***		2.05 (1.53-2.74)***		2.73 (1.95-3.81)***		2.44 (1.84-3.24)***		0.78 (.52-1.18)	
AOR1	1.51 (1.14-2.00)**		1.73 (1.26-2.37)**		2.41 (1.70-3.41)***		2.09 (1.53-2.86)***		1.50 (.94-2.40)	
AOR2	1.10 (.76-1.60)		1.23 (.81-1.85)		1.80 (1.15-2.82)*		1.86 (1.29-2.70)**		1.26 (.75-2.14)	
	Weighted N (weighted %)*									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>Back Problems</b>	1980 (13.2)	3140 (6.4)	1420 (9.6)	1580 (3.2)	1080 (7.4)	1040 (2.1)	1640 (11.2)	1700 (3.5)	660 (4.4)	2220 (4.5)
	Odds Ratios (95% CI)									
UOR	2.26 (1.85-2.75)***		3.21 (2.52-4.09)***		3.65 (2.72-4.90)***		3.46 (2.75-4.36)***		0.963 (.70-1.33)	
AOR1	2.21 (1.79-2.74)***		2.97 (2.29-3.85)***		3.41 (2.52-4.62)***		3.11 (2.44-3.97)***		1.41 (1.00-1.97)*	
AOR2	1.40 (1.05-1.87)*		1.78 (1.29-2.47)***		1.90 (1.23-2.92)**		2.17 (1.61-2.93)***		0.99 (.67-1.45)	
	Weighted N (weighted %)*									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>Migraines</b>	1020 (17.4)	4080 (7)	520 (8.9)	2500 (4.3)	460 (8)	1660 (2.9)	840 (14.5)	2480 (4.3)	340 (5.8)	2540 (4.4)
	Odds Ratios (95% CI)									
UOR	2.80 (2.16-3.62)***		2.18 (1.57-3.02)***		2.85 (1.98-4.09)***		3.80 (2.85-5.07)***		1.35 (.87-2.08)	
AOR1	2.62 (2.00-3.44)***		1.92 (1.38-2.66)***		2.49 (1.71-3.64)***		3.30 (2.41-4.50)***		1.66 (1.07-2.57)*	
AOR2	2.02		0.95		1.53		2.55		1.17	

	(1.43-2.86)***		(.60-1.48)		(.97-2.42)		(1.75-3.72)***		(.71-1.94)	
	Weighted N (weighted %)*									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>TBI</b>	380 (19.4)	4700 (7.5)	260 (13.5)	2740 (4.4)	200 (10.2)	1920 (3.1)	380 (19.8)	2920 (4.7)	140 (7.1)	2720 (4.4)
	Odds Ratios (95% CI)									
UOR	2.96 (2.06-4.26)***		3.34 (2.13-5.21)***		3.62 (2.16-6.05)***		5.08 (3.42-7.54)***		1.70 (.89-3.23)	
AOR1	2.91 (1.99-4.25)***		3.43 (2.16-5.44)***		3.30 (1.92-5.68)***		4.97 (3.30-7.47)***		1.71 (.91-3.20)	
AOR2	1.53 (.90-2.58)		1.66 (.87-3.18)		1.34 (.64-2.85)		3.57 (2.01-6.33)***		1.05 (.51-2.16)	

Note.  $p < 0.05^*$ ,  $p < 0.01^{**}$ ,  $p < 0.001^{***}$  N's are weighted and rounded to base 20, and percentages are based on rounded frequencies. CI = confidence interval; UOR = unadjusted odds ratio; AOR1 = odds ratio adjusted for age, sex, marital status, rank, Canadian Forces type, education, income, ethnicity; AOR2 = odds ratio adjusted for sociodemographics and all other mental disorders excluding the mental disorder of interest; Yes = prevalence rate of those who have the mental disorder of interest among each physical condition; No = prevalence of those who have the mental disorder of interest among those without the physical condition. Musculoskeletal problems = fibromyalgia and musculoskeletal problems; TBI = traumatic brain injury or concussion; MDE = major depressive episode; GAD = generalized anxiety disorder; PAD = panic disorder; PTSD = post-traumatic stress disorder; AUD = alcohol use disorder

**Table 3.** Proportions of endorsed chronic pain severity indicators among those with a physical condition with and without the mental disorder of interest

Physical Condition	Chronic Pain Severity		Chronic Pain Activity Limitation	
	No Pain/Mild Weighted N (weighted %)	Moderate/Severe Weighted N (weighted %)	No pain, None/a few Weighted N (weighted %)	Some to most Weighted N (weighted %)
	Mild: 6060 (9.4)	Moderate: 8940 (13.9) Severe: 1400 (2.2)	None: 3980 (6.2) A few: 4940 (7.7)	Some: 4440 (6.7) Most: 3020 (4.7)
<b>Other MSK Problems/Fibromyalgia</b>				
No MDE	11880 (69)	5320 (31)	13080 (76)	4100 (24)
Yes MDE	960 (40)	1400 (59)	1180 (50)	1200 (50)
No Panic Disorder	12220 (68)	5840 (32)	13480 (75)	4580 (25)
Yes Panic Disorder	400 (36)	700 (64)	480 (44)	600 (55)
No PTSD	12080 (69)	5420 (31)	13260 (76)	4240 (24)
Yes PTSD	600 (34)	1140 (66)	740 (43)	980 (56)
<b>Arthritis</b>				
No Panic Disorder	3580 (52)	3340 (48)	4360 (63)	2560 (37)
Yes Panic Disorder	100 (19)	440 (81)	140 (26)	400 (74)
No PTSD	3600 (54)	3140 (47)	4340 (65)	2380 (35)
Yes PTSD	140 (18)	640 (82)	220 (28)	560 (72)
<b>Back Problems</b>				
No MDE	9580 (74)	3420 (26)	9580 (74)	3420 (26)
Yes MDE	900 (45)	1100 (55)	900 (45)	1100 (56)
No GAD	9760 (73)	3680 (27)	9760 (73)	3680 (27)
Yes GAD	620 (44)	800 (56)	620 (44)	800 (56)
No Panic Disorder	9700 (72)	3800 (28)	9700 (72)	3800 (28)
Yes Panic Disorder	480 (44)	600 (56)	480 (44)	600 (56)
No PTSD	9600 (74)	3440 (26)	9600 (74)	3440 (26)
Yes PTSD	660 (40)	980 (60)	660 (40)	980 (60)
<b>Migraine</b>				
No MDE	3340 (69)	1520 (31)	3700 (76)	1140 (24)
Yes MDE	520 (51)	500 (49)	560 (55)	460 (45)
No PTSD	3420 (69)	1520 (31)	3780 (77)	1160 (24)
Yes PTSD	380 (45)	460 (45)	440 (52)	400 (48)
<b>TBI or Concussion</b>				
No PTSD	1000 (65)	540 (35)	1140 (74)	400 (26)
Yes PTSD	160 (42)	240 (63)	220 (58)	180 (47)

Note. Only relationships significant in most stringent model in Table 2 (AOR2) included. Unless otherwise indicated, numbers are weighted and rounded to base 20, and percentages are based on rounded frequencies.