

1
2
3
4 **An Examination of Chronic Pain and Mental Health Conditions in a Population-Based**
5 **Survey of Active Canadian Forces Personnel**
6
7
8
9
10

11
12 Everett Vun BSc¹, Sarah Turner MSc², Jitender Sareen MD³ Natalie Mota PhD⁴, Tracie O. Afifi
13 PhD² & Renée El-Gabalawy PhD^{4,5}
14
15
16
17
18

- 19
20 (1) Max Rady College of Medicine, University of Manitoba
21 (2) Department of Community Health Sciences, Max Rady College of Medicine, University of
22 Manitoba
23 (3) Department of Psychiatry, Max Rady College of Medicine, University of Manitoba
24 (4) Department of Clinical Health Psychology, Max Rady College of Medicine, University of
25 Manitoba
26 (5) Department of Anesthesia & Perioperative Medicine, Max Rady College of Medicine,
27 University of Manitoba
28
29
30
31
32

33 **Corresponding author:**

34 Renée El-Gabalawy PhD
35 AE-209, Harry Medovy House, 671 William Avenue Winnipeg, Manitoba, CANADA, R3E 0Z2
36 E-mail: renee.el-gabalawy@umanitoba.ca
37 Phone: (204)-787-2212; Fax: (204)-787-4291
38
39
40
41
42

43 **Current word count (manuscript excluding references): 2236**
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Abstract

Background: Chronic pain conditions and mental disorders are highly prevalent in military and veteran populations. Few investigations have been conducted examining the co-morbidity between chronic pain conditions and specific mental disorders among active Canadian military personnel.

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 and indicators of pain severity. Multiple logistic regressions assessed associations between chronic pain conditions and mental disorders. Weighted cross-tabulations assessed the prevalence of pain severity indicators in comorbid relationships compared to the chronic pain condition alone. Moderation analyses examined the interactions between pain condition by pain severity, and pain condition by activity limitation, respectively, on mental disorders.

Results: A quarter of military personnel endorsed chronic pain. In regressions adjusting for sociodemographics and mental disorders, all assessed pain conditions were significantly associated with PTSD (Odds Ratio Range (ORR): 1.86-3.57, $p < 0.01$). Back problems was significantly associated with all mental disorders apart from alcohol use disorders (ORR: 1.40-2.17, $p < 0.05$). Cross-tabulations demonstrated higher prevalences of endorsement for pain severity indicators among pain conditions and comorbid mental disorders, compared to pain conditions alone. Formal moderation analyses showed a significant relationship between migraine and activity limitation on PTSD (Odds Ratio (OR): .639, 95% CI: .430-.950, $p < 0.05$).

Interpretation: Chronic pain conditions are prevalent and co-occur with mental disorders among Canadian regular force members. Results are particularly robust for PTSD among active members.

Introduction

Chronic pain, physical conditions, and mental disorders are prevalent among military personnel. Chronic pain estimates in the Canadian Armed Forces (CAF) are estimated around 41%¹. Physical conditions characterized by pain are similar, with Regular Forces Canadian veterans having higher rates of arthritis, back pain and bowel disorders than the Canadian general population (CGP)². Military personnel also have high estimates of mental health conditions. In 2002, the Canadian Community Health Survey Canadian Forces Supplement (CCHS-CF) reported significantly higher prevalence rates of depression (past-year=7.6%) and panic disorder (past-year=2.2%) in the Regular members of the Canadian Forces compared to CGP³. These high prevalence rates are corroborated by more recent research. 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 CGP².

Interest in the relationship between mental disorders and pain conditions is growing. General population-based studies have found strong relationships between chronic physical conditions and depression^{4,5,6,7,8}, anxiety disorders^{9,10,11}, posttraumatic stress disorder (PTSD)^{12,13} among other mental disorders¹⁴. A major limitation with these studies is the lack of research looking at *specific* mental disorders; research examining comorbid relationships has primarily examined summary disorder categories due to limited statistical power. Lack of research examining chronic pain severity as a potential mechanism or differentiating factor for these co-morbid relationships is another limitation. Assessing pain severity would provide a better understanding of the role mental disorders have on the prevalence of pain severity and activity limitations among those with pain conditions. There are even greater gaps within the military context regarding co-morbidity research. First, military population research has primarily focused on PTSD and its relationship with physical conditions^{12,13,15}. Second, there is limited research within the Canadian military context regarding these comorbidities, particularly active military personnel. The current study addresses many of the limitations by investigating the relationships between specific mental disorders, chronic pain severity, and pain conditions in a contemporary active Canadian military sample.

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

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%;¹⁶). 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, 2013¹⁷. Ethical approval to conduct the survey was obtained through the relevant bodies within Statistics Canada¹⁶.

The CFMHS sample population consisted of Regular Force (RF) and Reservist Force members, however we only included RF members in this study as the Reservist Force members sampled were not a representative sample. Statistics Canada conducted a systematic sampling approach to ensure that regular members were nationally representative¹⁷.

Primary Variables

Mental Disorders. 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 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) criteria assessed past-year mental disorders. Major depressive episode (MDE), GAD, panic disorder, PTSD and alcohol use disorder (AUD) were included in the analysis. Research has shown concordance between the WHO-CIDI and Structured Clinical Interviews for DSM-IV (SCID)¹⁸.

Pain Conditions. Assessed physical conditions were characterized by pain symptoms, were expected to last at least 6 months and were based on self-report of being diagnosed by a health professional. Pain 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 self-reporting usual 'pain or discomfort', regardless of location. 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'. The respondent was also 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 prevalent responses and a sensitivity analysis: '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.

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 CFMHS¹⁹ 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. Cross-tabulations derived weighted frequencies for (1) presence of chronic pain among each physical condition and (2) the presence of individual mental disorders (i.e., MDE, GAD, panic disorder, PTSD, AUD) among each pain condition. Bivariate and multiple logistic regression models assessed the relationship between the pain conditions (independent variable) and each mental disorder (dependent variable). Multivariable 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 pain condition. This was conducted only among the pain conditions that were significantly associated with mental disorders in the most stringent logistic regression model. We then conducted a moderation analysis where two different interaction terms were used: (1) pain condition by pain severity and, (2) pain condition by activity limitation, and their association with significant mental disorders. Analyses were weighted so that results are representative of the CAF RF 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 software²⁰.

Results

Sample Description

Table 1 includes the sample size and weighted prevalence rates of the primary variables. 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 pain condition (30.5%).

Not listed in Table 1, cross-tabulations were also conducted looking at presence of chronic pain among each 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 pain condition. All pain conditions were significantly associated with MDE, GAD, panic disorder and PTSD in both the unadjusted model and the adjusted model accounting for sociodemographic variables. Once adjusting for other mental disorders, only the associations between PTSD and all pain conditions remained significant (PTSD ORR: 1.86-3.57). No significant relationships were seen between AUD and pain conditions in the most stringent model.

Pain Severity Analyses

Weighted cross-tabulations indicated that among the pain conditions, a larger proportion of individuals endorsed severe pain 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 the presence of a mental disorder yielding higher proportions of greater activity limitations compared to those with the pain condition alone. 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 endorsing some to most activities prevented among those with migraine.

Discussion

This was the first population-based investigation examining mental and physical health comorbidities and the impact of chronic pain among the active RF members of the CAF. The novel findings include (1) 25% of the sample experience regular chronic pain, (2) strength of the association between pain conditions and mental disorders vary depending on disorder, with robust findings for PTSD, and (3) among those with a pain condition, trends emerged suggesting higher estimates of more severe pain indicators – in terms of both pain severity and impact on functioning – in those with a comorbid mental disorder compared to those without.

Chronic pain is common among active CAF members (25.5%) with the majority indicating their pain is moderate to severe. Indeed, 75% of those with chronic pain reported some impact on functioning. High rates of pain conditions were also found and may be explained by the sample's physically intensive work demands. Military work is often unpredictable and demanding²¹, and deployed soldiers endure high non-battle injury rates²², and poly-traumatic injuries²³. Pain conditions assessed could be sequelae of past injuries, considering that injury-induced arthritis²⁴ and injury-related disc degeneration²⁵ does occur. Migraines, TBI and back problems can be related to injury too^{26,27}.

Two unique co-morbidity trends appeared: non-significant relationships between physical conditions and AUD, and robust findings related to PTSD. Alcohol use is associated with chronic physiologic diseases²⁸, however, the nature of the sample could explain our non-significant findings. AUD – a functionally-impairing disorder – may not show in a population who are capable of working as active militants, suggesting lower drinking-impairment. This is likely, given the prevalence of AUD is lower in the RF population compared to the CGP²⁹. This may be particularly true for personnel with pain conditions where the combination may result in an inability to work. Unlike AUD, PTSD had strong associations with all assessed pain conditions, paralleling trends seen in the CGP³⁰. The association 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 military³¹. Shared determinant of combat exposure is a likely explanation, as both PTSD³² and TBI³³ can develop from such exposure. PTSD may be predictive of a pain condition through its symptomatology profile, or through a secondary mechanism such as maladaptive behavior. Sleep disturbance is also common in PTSD³⁴ and poor quality of sleep is significantly associated with physical illness³⁶⁻⁴⁰ and often seen in veterans³⁵. Therefore, poor sleep may be a propagating factor for these comorbidities. Regarding maladaptive behaviours, escape-avoidance behaviors (drinking, smoking, etc.) are methods of coping after trauma^{41,42}, and are associated with many health conditions^{43,44,45,46,47}. Deployment may prompt maladaptive behaviors to cope⁴⁸, corroborated by increased incidences in smoking in deployed compared to non-deployed personnel⁴⁹. Additional possible mechanisms may include physiological indicators (e.g., increases in

1
2
3
4 proinflammatory cytokines following stress exposure) or genetic factors⁵⁰. Additionally, back
5 problems remained significant with most mental disorders in the most stringent model, possibly due
6 to the heterogeneity of this group and/or the psychosomatic features indicated in back pain⁵³. Among
7 these comorbid findings, cross-tabulations demonstrated increased pain severity indicators among
8 those with comorbid physical and mental health conditions compared to those with a physical
9 condition alone. This trend was again particularly robust for PTSD. Otis supports a possible
10 explanation on the premise that PTSD and chronic pain both have unpredictable and uncontrollable
11 symptoms⁵⁴. This shared factor may contribute to their simultaneous development⁵⁴, and perhaps
12 worsen symptoms synergistically. This is supported by PTSD symptom severity correlating with
13 chronic pain severity in those with chronic pain and PTSD⁵⁵. Several other relationships were
14 trending towards significance ($p < .1$), including migraine by pain severity on MDE, migraine by pain
15 severity on PTSD and back problems by pain limitations on panic disorder ($p = .066, .089, .074$,
16 respectively), further supporting this trend.
17

18 Limitations of this study include, first, the cross-sectional survey design. Second, the self-
19 reported pain conditions may result in biased estimates. However, research has demonstrated a high
20 concordance between self-reported physical conditions and physician diagnosed conditions⁵⁶. Third,
21 focusing on the RF sample narrows generalizability to all RF members of the CAF. Finally, with the
22 majority of the sample being male our findings may be less generalizable to female military
23 personnel. Despite these limitations, this study demonstrates that RF personnel have high rates of
24 pain conditions, and a significant proportion experience regular pain. Further, there is a high
25 comorbidity between pain conditions and mental disorders, particularly PTSD. Emphasis on mental
26 disorder screening (especially in the context of pain conditions) and prompt management of pain
27 conditions in the primary setting in the CAF is implied. Longitudinal research examining the
28 development of comorbid mental and pain conditions within this population should be a priority. This
29 study reveals pertinent information regarding comorbidities and chronic pain that is
30 underrepresented in the literature.
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

References

1. VanDenKerkhof EG, VanTil L, Thompson JM, et al. Pain in Canadian Veterans: Analysis of data from the Survey on Transition to Civilian Life. *Pain Res Manag*. 2015;20(2):89-95.
2. Thompson J, MacLean MB, Val Til L, et al. *Survey on Transition to Civilian Life : Report on Regular Force Veterans*. Ottawa: Research Directorate, Veterans Affairs Canada, Charlottetown, and Director General Military Personnel Research and Analysis, Department of National Defence; 2011.
3. ARCHIVED - Statistics Canada Survey Results in Tabular Form. National Defence and the Canadian Armed Forces. <http://www.forces.gc.ca/en/about-reports-pubs-health/cchs-cf-supplement-2002-tables.page>. Published 2002. Accessed June 24, 2016.
4. Atlantis E, Shi Z, Penninx BJWH, Wittert GA, Taylor A, Almeida OP. Chronic medical conditions mediate the association between depression and cardiovascular disease mortality. *Soc Psychiatry Psychiatr Epidemiol*. 2012;47(4):615-625. doi:10.1007/s00127-011-0365-9.
5. Stein MB, Cox BJ, Afifi TO, Belik SL, Sareen J. Does co-morbid depressive illness magnify the impact of chronic physical illness? A population-based perspective. *Psychol Med*. 2006;36(5):587-596. doi:10.1017/S0033291706007239.
6. Gunn JM, Ayton DR, Densley K, et al. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. *Soc Psychiatry Psychiatr Epidemiol*. 2012;47(2):175-184. doi:10.1007/s00127-010-0330-z.
7. Gabilondo A, Vilagut G, Pinto-Meza A, Haro JM, Alonso J. Comorbidity of major depressive episode and chronic physical conditions in Spain, a country with low prevalence of depression. *Gen Hosp Psychiatry*. 2012;34(5):510-517. doi:10.1016/j.genhosppsych.2012.05.005.
8. Fiest KM, Currie SR, Williams JVA, Wang J. Chronic conditions and major depression in community-dwelling older adults. *J Affect Disord*. 2011;131(1-3):172-178. doi:10.1016/j.jad.2010.11.028.
9. El-Gabalawy R, Mackenzie CS, Shoostari S, Sareen J. Comorbid physical health conditions and anxiety disorders: A population-based exploration of prevalence and health outcomes among older adults. *Gen Hosp Psychiatry*. 2011;33(6):556-564. doi:10.1016/j.genhosppsych.2011.07.005.
10. Sareen J, Jacobi F, Cox BJ, Belik S-L, Clara I, Stein MB. Disability and Poor Quality of Life Associated With Comorbid Anxiety Disorders and Physical Conditions. *Arch Intern Med*. 2016;166:2109-2116.
11. Sareen J, Cox BJ, Clara I, Asmundson GJG. The relationship between anxiety disorders and physical disorders in the U.S. National Comorbidity Survey. *Depress Anxiety*. 2005;21(4):193-202. doi:10.1002/da.20072.
12. Pacella ML, Hruska B, Delahanty DL. The physical health consequences of PTSD and PTSD symptoms: A meta-analytic review. *J Anxiety Disord*. 2013;27(1):33-46. doi:10.1016/j.janxdis.2012.08.004.
13. Fetzner MG, Mcmillan KA, Asmundson GJG. Similarities in specific physical health disorder prevalence among formerly deployed Canadian forces veterans with full and subsyndromal PTSD. *Depress Anxiety*. 2012;29(11):958-965. doi:10.1002/da.21976.
14. Buist-Bouwman MA, De Graaf R, Vollebregt WAM, Ormel J. Comorbidity of physical and mental disorders and the effect on work-loss days. *Acta Psychiatr Scand*. 2005;111(6):436-

- 1
2
3
4 443. doi:10.1111/j.1600-0447.2005.00513.x.
- 5
6 15. O'Toole BI, Catts S V. Trauma, PTSD, and physical health: An epidemiological study of
7 Australian Vietnam veterans. *J Psychosom Res.* 2008;64(1):33-40.
8 doi:10.1016/j.jpsychores.2007.07.006.
- 9
10 16. Zamorski MA, Bennett RE, Boulos D, Garber BG, Jetly R, Sareen J. The 2013 Canadian
11 Forces Mental Health Survey: Background and Methods. *Can J Psychiatry.*
12 2016;61(Supplement 1):10s-25s. doi:10.1177/0706743716632731.
- 13
14 17. Canadian Forces Mental Health Survey. Statistics Canada.
15 <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5084>. Published 2014.
16 Accessed June 20, 2016.
- 17
18 18. Haro JM, Arbabzadeh-bouchez S, Brugha TS, et al. Concordance of the Composite
19 International with standardized clinical assessments in the WHO World Mental Health
20 Surveys. *Int J Methods Psychiatr Res.* 2006;15(4):167-180. doi:10.1002/impr.
- 21
22 19. Afifi TO, Taillieu T, Zamorski MA, Turner S, Cheung K, Sareen J. Association of child abuse
23 exposure with suicidal ideation, suicide plans, and suicide attempts in military personnel and
24 the general population in Canada. *JAMA Psychiatry.* 73(3):229-238.
25 doi:10.1001/jamapsychiatry.2015.2732.
- 26
27 20. Software SS. StataCorp. 2015.
- 28
29 21. Boulos D, Zamorski MA. Military Occupational Outcomes in Canadian Armed Forces
30 Personnel with and without Deployment-Related Mental Disorders. *Can J Psychiatry.*
31 2016;61(6):348-357. doi:10.1177/0706743716643742.
- 32
33 22. Patel AA, Hauret KG, Taylor BJ, Jones H. Non-battle injuries among U . S . Army soldiers
34 deployed to Afghanistan. *J Safety Res.* 2017;60:29-34. doi:10.1016/j.jsr.2016.11.004.
- 35
36 23. Geiling J, Rosen JM, Edwards RD. Medical Costs of War in 2035 : Long-Term Care
37 Challenges for Veterans of Iraq and Afghanistan. *Mil Med.* 2012;177:1235-1244.
38 doi:10.7205/MILMED-D-12-0003I.
- 39
40 24. Brown TD, Johnston RC, Saltzman CL, Marsh JL, Buckwalter JA. Posttraumatic
41 Osteoarthritis : A First Estimate of Incidence , Prevalence , and Burden of Disease. *J Orthop*
42 *Trauma.* 2006;20(10):739-744.
- 43
44 25. Adams MA. Biomechanics of back pain. *Acupunct Med.* 2004;22(4):178-188.
- 45
46 26. Knapik J, Reynolds K, Harman E. Soldier Load Carriage: Historical, Physiological,
47 Biomechanical, and Medical Aspects. *Mil Med.* 2004;169:45-56.
- 48
49 27. Ruff RL, Ruff SS, Wang XF. Headaches among Operation Iraqi Freedom/Operation Enduring
50 Freedom veterans with mild traumatic brain injury associated with exposures to explosions. *J*
51 *Rehabil Res Dev.* 2008;45(7):941-952. doi:10.1682/JRRD.2008.02.0028.
- 52
53 28. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global
54 burden of disease and injury and economic cost attributable to alcohol use and alcohol-use
55 disorders. *Lancet.* 2009;373(9682):2223-2233. doi:10.1016/S0140-6736(09)60746-7.
- 56
57 29. Rusu C, Zamorski MA, Boulos D, Garber BG. Prevalence Comparison of Past-year Mental
58 Disorders and Suicidal Behaviours in the Canadian Armed Forces and the Canadian General
59 Population. *Can J Psychiatry.* 2016;61(Supplement 1):46s-55s.
60 doi:10.1177/0706743716628856.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
30. Sareen J, Cox BJ, Stein MB, Afifi TO, Fleet C, Asmundson GJG. Physical and Mental Comorbidity, Disability, and Suicidal Behavior Associated With Posttraumatic Stress Disorder in a Large Community Sample. *Psychosom Med*. 2007;69(3):242-248. doi:10.1097/PSY.0b013e31803146d8.
 31. Hesdorffer DC, Rauch SL, Tamminga CA. Long-term Psychiatric Outcomes Following Traumatic Brain Injury : A Review of the Literature. *J Head Trauma Rehabil*. 2009;24(6):452-459.
 32. Dedert EA, Green KT, Calhoun PS, et al. Association of trauma exposure with psychiatric morbidity in military veterans who have served since September 11, 2001. *J Psychiatr Res*. 2009;43(9):830-836. doi:10.1016/j.jpsychires.2009.01.004.Association.
 33. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA. Mild Traumatic Brain Injury in U.S. Soldiers Returning from Iraq. *N Engl J Med*. 2008;358:453-463.
 34. American Psychiatric Association. *American Psychiatric Association: Desk Reference to the Diagnostic Criteria From DSM-5*. Arlington, VA; 2013.
 35. Lewis VJ, Creamer M, Failla S. Is Poor Sleep in Veterans a Function of Post- Traumatic Stress Disorder ? *Mil Med*. 2009;174(September 2009):948-951. doi:10.7205/MILMED-D-04-0208.
 36. Gangwisch JE, Heymsfield SB, Boden-albala B, et al. Short Sleep Duration as a Risk Factor for Hypertension Analyses of the First National Health and Nutrition Examination Survey. *Hypertension*. 2006;47:833-839. doi:10.1161/01.HYP.0000217362.34748.e0.
 37. Schwartz SW, Cornoni-huntley J, Cole SR, Hays JC, Blazer DANG, Schocken DD. Are Sleep Complaints an Independent Risk Factor for Myocardial Infarction? *Ann Epidemiol*. 1998;8:384-392.
 38. Ayas NT, White DP, Al-Delaimy WK, et al. A Prospective Study of Self-Reported Sleep Duration and Incident Diabetes in Women. *Diabetes Care*. 2003;26(2):380-384.
 39. Ayas NT, White DP, Manson JE, et al. A Prospective Study of Sleep Duration and Coronary Heart Disease in Women. *Arch Intern Med*. 2003;163:205-209.
 40. Zee P, Turek F. Sleep and Health. *Arch Intern Med*. 2006;166:1686-1688.
 41. Chang C-M, Lee L-C, Connor K, Davidson JRT, Jeffries K, Lai T-J. Posttraumatic Distress and Coping Strategies among Rescue Workers after an Earthquake. *J Nerv Ment Dis*. 2003;191(6):391-398. doi:10.1097/01.NMD.0000071588.73571.3D.
 42. Olf M, Langeland W, Olf M, Langeland W, Gersons BPR. The psychobiology of PTSD: Coping with trauma. *Psychoneuroendocrinology*. 2005;(December):1-9. doi:10.1016/j.psyneuen.2005.04.009.
 43. Bartecchi CE, MacKenzie TD, Schrier RW. The Human Costs of Tobacco Use. *N Engl J Med*. 1994;330:907-912.
 44. Rehm J, Monteiro M. Alcohol consumption and burden of disease in the Americas : implications for alcohol policy. *Rev Panam Salud Pública*. 2005;18:241-248.
 45. Russell M, Rasmussen B, Fenger K, Olesen J. Migrain without aura and migraine with aura are distinct clinical entities: a study of four hundred and eighty-gour male and female migraineurs from the general population. *Cephalagia*. 1996;16:239-245.
 46. Panconesi A. Alcohol and migraine trigger factor, consumption, mechanisms. A review. *J*

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
- Headache Pain*. 2008;9:19-27. doi:10.1007/s10194-008-0006-1.
47. Yunus MB, Arslan S, Aldag JC, Yunus MB, Arslan S, Aldag JC. Relationship between fibromyalgia features and smoking. *Scand J Rheumatol*. 2002;31:300-305. doi:10.1080/030097402760375214.
48. Sudom K, Zamorski M, Garber B. Stigma and Barriers to Mental Health Care in Deployed Canadian Forces Personnel. *Mil Psychol*. 2012;24:414-431. doi:10.1080/08995605.2012.697368.
49. Smith B, Ryan MAK, Wingard DL, Patterson TL. Cigarette Smoking and Military Deployment. *Am J Prev Med*. 2008;35(6):539-546. doi:10.1016/j.amepre.2008.07.009.
50. Stein MB, Chen C, Ursano RJ, et al. Genome-wide Association Studies of Posttraumatic Stress Disorder in 2 Cohorts of US Army Soldiers. *JAMA Psychiatry*. 2016;73(7):695-704. doi:10.1001/jamapsychiatry.2016.0350.
51. Bhattacharya R, Shen C, Sambamoorthi U. Excess risk of chronic physical conditions associated with depression and anxiety. *BMC Psychiatry*. 2014;14:10. doi:10.1186/1471-244X-14-10.
52. Scott KM, Bruffaerts R, Tsang A, Ormel J, Alonso J, Angermeyer MC. Depression – anxiety relationships with chronic physical conditions : Results from the World Mental Health surveys ☆. *J Affect Disord*. 2007;103:113-120. doi:10.1016/j.jad.2007.01.015.
53. Chaturvedi SK, Parameshwaran S. Psychosomatic Medicine. In: *International Encyclopedia of Social & Behavioral Sciences*. Vol 19. Second Edi. Elsevier; 2015:484-490. doi:10.1016/B978-0-08-097086-8.27057-8.
54. Otis JD, Keane TM, Kerns RD. An examination of the relationship between chronic pain and post-traumatic stress disorder. *J Rehabil Res Dev*. 2003;40(5):397-405. doi:10.1682/JRRD.2003.09.0397.
55. Defrin R, Ginzburg K, Solomon Z, et al. Quantitative testing of pain perception in subjects with PTSD - Implications for the mechanism of the coexistence between PTSD and chronic pain. *Pain*. 2008;138(2):450-459. doi:10.1016/j.pain.2008.05.006.
56. Baumeister H, Kriston L, Bengel J, Härter M. High agreement of self-report and physician-diagnosed somatic conditions yields limited bias in examining mental-physical comorbidity. *J Clin Epidemiol*. 2010;63(5):558-565. doi:10.1016/j.jclinepi.2009.08.009.
57. Menear M, Dore I, Cloutier AM, et al. The influence of comorbid chronic physical conditions on depression recognition in primary care: A systematic review. *J Psychosom Res*. 2015;78(4):304-313. doi:10.1016/j.jpsychores.2014.11.016.
58. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting D, Koffman R. Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care. *New Englad J Med*. 2004;351(1):13-22. doi:10.1056/NEJMoa1514204.

**Table 1. Primary sample characteristics
(N = 6696)**

Age (mean, SE)	35.4 (.11)
	Weighted N (weighted %)
Canadian Force Type	
Navy	11080 (17.2)
Army	34220 (53.1)
Air Force	19100 (29.7)
Canadian Force Rank	
Junior Non-Commissioned Member	35440 (55)
Senior Non-Commissioned Member	15500 (24.1)
Officer	13460 (20.9)
Sex	
Male	55480 (86.1)
Female	8920 (13.9)
Ethnic Minority	
No	57900 (90.1)
Yes	6360 (9.9)
Marital Status	
Married or common-law	42200 (65.6)
Widowed, separated or divorced	4840 (7.5)
Single, never married	17300 (26.9)
Income	
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)
Education	
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)
Physical Conditions	
Fibromyalgia and musculoskeletal problems	19600 (30.5)
Arthritis	7680 (12.4)
Back problems	14980 (23.3)
Migraine	5880 (9.1)
TBI or concussion	1960 (3.1)
Past-Year Mental Disorders	
Major depressive episode	5120 (8)
GAD	3000 (4.7)
Panic Disorder	2140 (3.4)
PTSD	3340 (5.3)
AUD	2880 (4.5)

Chronic Pain Characteristics

Presence		
Yes		16400 (25.5)
No		47980 (74.5)
Severity		
Mild		6060 (9.4)
Moderate		8940 (13.9)
Severe		1400 (2.2)
Number of activities prevented		
None		3980 (6.2)
A few		4940 (7.7)
Some		4440 (6.7)
Most		3020 (4.7)

Note. Unless otherwise indicated numbers are weighted and rounded to base 20 according to Statistics Canada release policies, and percentages are based on rounded frequencies. Missing data are excluded; therefore, prevalence rates may not always add to 100% in each category. TBI = traumatic brain injury
GAD = general anxiety disorder PTSD = post-traumatic stress disorder

Confidential

Table 2. Logistic regressions analyzing the relationships between pain 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
MSK Problems	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
Arthritis	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)***		.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
Back Problems	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)***		.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)***		.99 (.67-1.45)	
	Weighted N (weighted %)*									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Migraines	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		.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
TBI	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. $p < 0.05^*$, $p < 0.01^{**}$, $p < 0.001^{***}$ *Unless otherwise indicated numbers are weighted and rounded to base 20 according to Statistics Canada release policies, 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 age, sex, marital status, rank, Canadian Forces type, education, income, ethnicity, 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 pain

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 %)
Other MSK Problems/Fibromyalgia				
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)
Arthritis				
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)
Back Problems				
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)
Migraine				
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)
TBI or Concussion				
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 according to Statistics Canada release policies, and percentages are based on rounded frequencies.