

**PREVALENCE OF CHRONIC PAIN AMONG MILITARY VETERANS  
AND RESEARCH PRIORITIES AMONG MILITARY VETERANS LIVING  
WITH CHRONIC PAIN**

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for the Degree of:

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The following sections of this thesis have been submitted to peer-reviewed journals:

### **CHAPTER 2:** Prevalence of Chronic Non-Cancer Pain among Military Veterans

Title: Prevalence of Chronic Non-Cancer Pain among Military Veterans – A Systematic Review and Meta-Analysis

Submitted to: BMJ Military Health

Status: Under consideration.

### **CHAPTER 3:** Research Priorities among Canadian Military Veterans living with Chronic Pain

Title: Research Priorities among Canadian Military Veterans living with Chronic Pain: A Cross-Sectional Survey

Submitted to: Military Medical Research

Status: Under consideration.

## **LIST OF ABBREVIATIONS**

CNCP = Chronic non-cancer pain

CI = Confidence interval

GRADE = Grading of Recommendations, Assessment, Development and Evaluation

HiREB = Hamilton Integrated Research Ethics Board

ICEMAN = Instrument to assess the Credibility of Effect Modification Analyses

IQR = Interquartile range

PTSD = Post-traumatic stress disorder

PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Q = Question

RCMP = Royal Canadian Mounted Police

ROB = Risk of bias

STROBE = Strengthening the Reporting of Observational Studies in Epidemiology

TBI = Traumatic brain injury

VA = Veterans Affairs

## **CHAPTER 1 – Thesis Introduction**

### **1.1 THESIS INTRODUCTION**

Chronic non-cancer pain (CNCP) is defined as pain that persists for  $\geq 3$  months and is not caused by cancer.<sup>1</sup> CNCP is a pervasive issue that disproportionately affects military veterans in comparison to the general public.<sup>2</sup> A previous systematic review estimated the prevalence of CNCP in military veterans to range from 25% to 72%.<sup>3</sup> However, the data from eligible studies was narratively synthesized, and this review did not attempt to generate a pooled prevalence or explain between-study heterogeneity. Furthermore, the search for this review was conducted up to 2013, and hence needs updating.<sup>3</sup> Therefore, we conducted a systematic review and meta-analysis to explore the prevalence of CNCP among veterans addressing the limitations of the former review. Determining the prevalence of CNCP will help to increase our understanding of the burden of chronic pain among military veterans.

Chronic pain is an important issue for veterans, and research is increasingly being funded to prevent and optimize management of chronic pain. While encouragement of pain research is laudable, a 2010 U.S. study estimated that \$204 billion U.S. dollars directed towards medical research is wasted, and a one reason was the lack of alignment with the needs of patients.<sup>4</sup> Consequently, there is a need for greater involvement of patients in the process of conducting and designing research. A recent qualitative study identified several research priorities of military veterans living with chronic pain;<sup>5</sup> however, the generalizability of these priorities was uncertain. Hence, we conducted a cross-sectional survey to determine the generalizability of identified research priorities among military veterans living with chronic pain. Seeking such priorities from this population will help to ensure that future research aligns with their needs.

Overall, this dissertation aims to provide insight into the following research questions:

1. What is the prevalence of CNCP in military veterans?
2. What are the research priorities of military veterans living with chronic pain?

## **1.2. REFERENCES**

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- <sup>4</sup> Chalmers, I., & Glasziou, P. (2009). Avoidable waste in the production and reporting of research evidence. *The Lancet*, *374*(9683), 86-89.
- <sup>5</sup> Kithulegoda N, Strachan P, Zacharias R, Buckley N, Busse JW. Exploring Canadian Veteran's Priorities Regarding Chronic Pain Research: A Qualitative Study. *Journal of Military, Veteran and Family Health*. 2021. doi.org/10.3138/jmvfh-2021-0045. Online ahead of print.



## **CHAPTER 2 – Prevalence of Chronic Non-Cancer Pain among Military Veterans**

### **2.1. ABSTRACT**

**Introduction:** There is uncertainty in the prevalence of chronic non-cancer pain (CNCP) in military veterans. A systematic review and meta-analysis was conducted to elucidate this issue, and examine potential effect modifiers of CNCP prevalence.

**Methods:** MEDLINE, EMBASE, PsycINFO, CINAHL, Web of Science were searched from 2013 to January 21, 2021, for observational studies reporting “chronic pain” or pain  $\geq 3$  months in military veterans. The random-effects meta-analysis was used for pooling data, the Grading of Recommendations, Assessment, Development and Evaluations approach was used for rating quality of evidence, and the Instrument to Assess the Credibility of Effect Modification Analyses was used to rate credibility of the subgroup analyses.

**Results:** 41 observational studies with 5,550,375 military veterans were included. The overall pooled CNCP prevalence is 34% (95% confidence interval (CI) 25% to 45%). However, significant subgroup effect was found for type of prevalence measure (generic or specific) among military veterans (test of interaction  $p=0.007$ , moderate subgroup credibility): the pooled generic CNCP prevalence of 43%, 95% CI 29% to 57% (Low-certainty evidence) vs. the pooled specific type of CNCP prevalence of 14%, 95% CI 6.7% to 23% (Moderate-certainty evidence). A multivariable meta-regression model adjusted for proportion lost to follow-up found the type of prevalence measure to be the only significant predictor of CNCP prevalence ( $p < 0.0001$ ).

**Conclusion:** The overall prevalence of CNCP is 34% among military veterans. For generic CNCP, the prevalence is 43%; for a given subtype of CNCP, the prevalence is 11%.

Methodologically robust studies are required to more precisely determine CNCP prevalence.

## **2.2. INTRODUCTION**

Chronic pain is defined as pain persisting for  $\geq 3$  months.<sup>1</sup> Chronic pain is a pervasive problem among military veterans, as it has a detrimental impact on physical functioning<sup>2</sup> and physical health-related quality of life,<sup>3</sup> and is often comorbid with depression<sup>4</sup> and substance use disorders<sup>5</sup>. While it is known that chronic pain prevalence is generally higher in military veterans than in the general population,<sup>6</sup> an accurate estimate of chronic pain prevalence in military veterans has yet to be determined. A prior review found the CNCP prevalence among veterans to range from 25% to 72%; however, there was no point estimate provided, and the authors did not explore factors associated with the variability between studies using quantitative analytic methods.<sup>7</sup> Furthermore, the search of the prior review was conducted up to 2013 and is therefore in need of updating.<sup>7</sup> The objective of the present systematic review was to expand on the search of the prior review, as well as utilize meta-analyses to explore CNCP prevalence and factors that are associated with the variability in CNCP prevalence among military veterans.

## **2.3. METHODS**

We followed the reporting of Meta-analysis Of Observational Studies in Epidemiology (MOOSE) statement<sup>8</sup> and registered our protocol on the Open Science Framework (<https://osf.io/pe52w>).

### **2.3.1. Search strategy**

An academic librarian (RC) developed and adapted the search strategies from a prior review on CNCP prevalence in military veterans.<sup>7</sup> We searched MEDLINE, CINAHL, Embase, PsycINFO and Web of Science for articles dating since 2013 to March 30th, 2020. After the publication of

the protocol, the search was updated to encompass articles dating from March 31<sup>st</sup>, 2020 to January 18<sup>th</sup>, 2021. A manual search of reference lists of included studies was conducted to identify additional eligible articles.

### **2.3.2. Study selection**

Two reviewers (AQ and MP) independently screened titles and abstracts of articles retrieved from the results of the search strategy for eligibility. All potentially eligible articles were retrieved in full text and reviewed to confirm eligibility. DistillerSR (Evidence Partners, Ottawa, Canada; <http://systematic-review.net>) was used to facilitate literature screening. Reviewers resolved any disagreements on study eligibility through discussion or with assistance from an adjudicator (JWB) when required. To assess inter-rater agreement for full-text eligibility, an adjusted kappa was calculated.<sup>9</sup>

#### **2.3.2.1. Inclusion criteria**

1. An observational study, including a prospective cohort study, cross-sectional study or retrospective cohort study, that explores the prevalence of CNCP among veterans.
2. Enrolled  $\geq 100$  military veterans.
3. The study is published in the English-language.

#### **2.3.2.2. Exclusion criteria**

1. Solely examines a population (or subset) of military veterans that are seeking (or have sought) pain specialty care.
2. Solely examining a population (or subset) of military veterans with CNCP.

3. Veterans represents less than 80% of a study population unless the results for veterans are reported separately.
4. Conference abstracts, dissertations, letters to the Editor and quality improvement studies.
5. Randomized controlled trials.
6. Case-control studies.

We also excluded studies with  $n \leq 100$  participants because smaller studies are more prone to bias, less representative, and these studies likely contribute very little weight to the pooled prevalence analysis.

### **2.3.3. Data extraction and collection**

A piloted electronic data extraction form was utilized. Data extraction was conducted independently by two reviewers. Reviewers resolved discrepancies by discussion, or with the help of a third reviewer if consensus was not achieved. Key variables collected pertain to study information, population characteristics, information concerning the assessment of chronic pain, and risk of bias. The complete list of data collected is available in the “Measured variables” section of the protocol of this review (<https://osf.io/pe52w>).

#### **2.3.3.1. *Chronic non-cancer pain***

We defined chronic non-cancer pain (CNCP) as pain  $\geq 3$  months in duration or pain simply defined by authors to be “chronic”.<sup>1</sup> All outcome measures for CNCP prevalence were extracted. If the prevalence of CNCP was only reported according to subtypes (e.g., neuropathic), we considered the possibility of clustering in that some veterans may have more than one type of

CNCP. Hence, authors were contacted to retrieve a single value for an independent CNCP prevalence. If contacting authors was unsuccessful, then the study was included in the qualitative analysis but not in any quantitative analysis. If a study only reported CNCP prevalence for independent subgroups, then the subgroups were combined to derive an overall CNCP prevalence. Moreover, studies were evaluated in terms of which criteria are met in the definition of primary chronic pain of the International Association for the Study of Pain; these criteria are persistence (pain in  $\geq 1$  more regions for  $\geq 3$  months), emotional distress or functional disability, and pain not being better explained by any other condition.<sup>1</sup>

#### **2.3.4. Risk of bias assessment (ROB)**

Pairs of reviewers assessed each eligible study, independently and in duplicate, for the following risk of bias (ROB) items, which are based on the Users' Guide to the Medical Literature.<sup>10</sup>

1. Representativeness of study population: Is the sample representative of a general population of veterans?
2. Validity of outcome measure: Did the authors use a valid outcome measure to assess chronic non-cancer pain (CNCP) prevalence?
3. Risk of under-reporting bias: Was each participant systematically approached, asked or assessed for prevalence of CNCP?
4. Missing data: What is the percentage of missing CNCP prevalence data in this study?  $\geq 20\%$  missing data was considered as high ROB.

#### **2.3.5. Data synthesis and analysis**

A random-effects model was used to pool CNCP prevalence with an associated 95% confidence interval (CI),<sup>11</sup> after performing a Freeman-Tukey double arcsine transformation to stabilize the variance.<sup>12</sup> The DerSimonian and Laird method was used to compute the pooled prevalence estimates based on the transformed values and variances,<sup>13</sup> and subsequently the harmonic means of sample sizes for the back-transformation to the original units of proportions.<sup>14</sup> Subgroup analyses were only conducted if there were  $\geq 2$  studies within each subgroup.

### **2.3.5.1 Subgroup analyses, meta-regression, and sensitivity analyses**

We examined heterogeneity for our pooled estimate through visual inspection of the forest plot and  $\tau^2$  (Tau<sup>2</sup>), as the I-squared and chi-squared tests of heterogeneity can be misleading when studies have large sample sizes and associated measures of precision are therefore very narrow.<sup>15,16</sup>  $\tau$  represents the standard deviation of the effects between studies and has the same units as the pooled variable (in our case, percentage).<sup>11</sup> Heterogeneity is considerable if the range of the pooled estimate  $\pm 2 \tau$  is too broad.<sup>17</sup>

We generated the following *a priori* subgroup hypotheses to explain variability between studies, assuming a higher prevalence of CNCP with: (i) smaller ( $n < 1000$ ) vs larger ( $n > 1000$ ) studies, (ii) female vs male veterans, (iii) patient-reported vs clinician-assessed CNCP, (iv) low threshold [e.g., any pain] vs high threshold [e.g., moderate to severe pain] for defining CNCP, and (v) high vs low risk of bias (ROB) on a criterion-by-criterion basis. Subgroup analyses were only conducted if there were  $\geq 2$  studies within each subgroup.

We also performed a *post hoc* subgroup hypothesis to explain variability between studies, assuming a higher prevalence of CNCP with studies reporting a generic CNCP prevalence vs a subtype of CNCP prevalence.

We performed univariable meta-regression to explore the association between proportion lost to follow-up with the prevalence of CNCP. Additionally, we expanded this meta-regression to a multivariable meta-regression by adding in any subgrouping variables that were statistically significant.

The credibility of the subgroup analyses and the meta-regression was assessed using the Instrument to assess the Credibility of Effect Modification Analyses (ICEMAN) criteria.<sup>19</sup>

We performed a sensitivity analysis to examine the impact of logit transformation instead of the Freeman-Tukey double arcsine transformation on the pooled prevalence of CNCP.<sup>16</sup> All statistical analyses were conducted using R version 4.0.3 and RStudio version 1.3.1093 (R Core Team, Vienna, Austria). All comparisons were two-tailed, with a threshold p of 0.05.

### **2.3.6. Certainty of evidence**

The pooled estimates from the meta-analyses of the included studies were evaluated for their quality of evidence using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) framework (**Table 1**).<sup>20</sup>

### **2.3.7 Small-study effects**

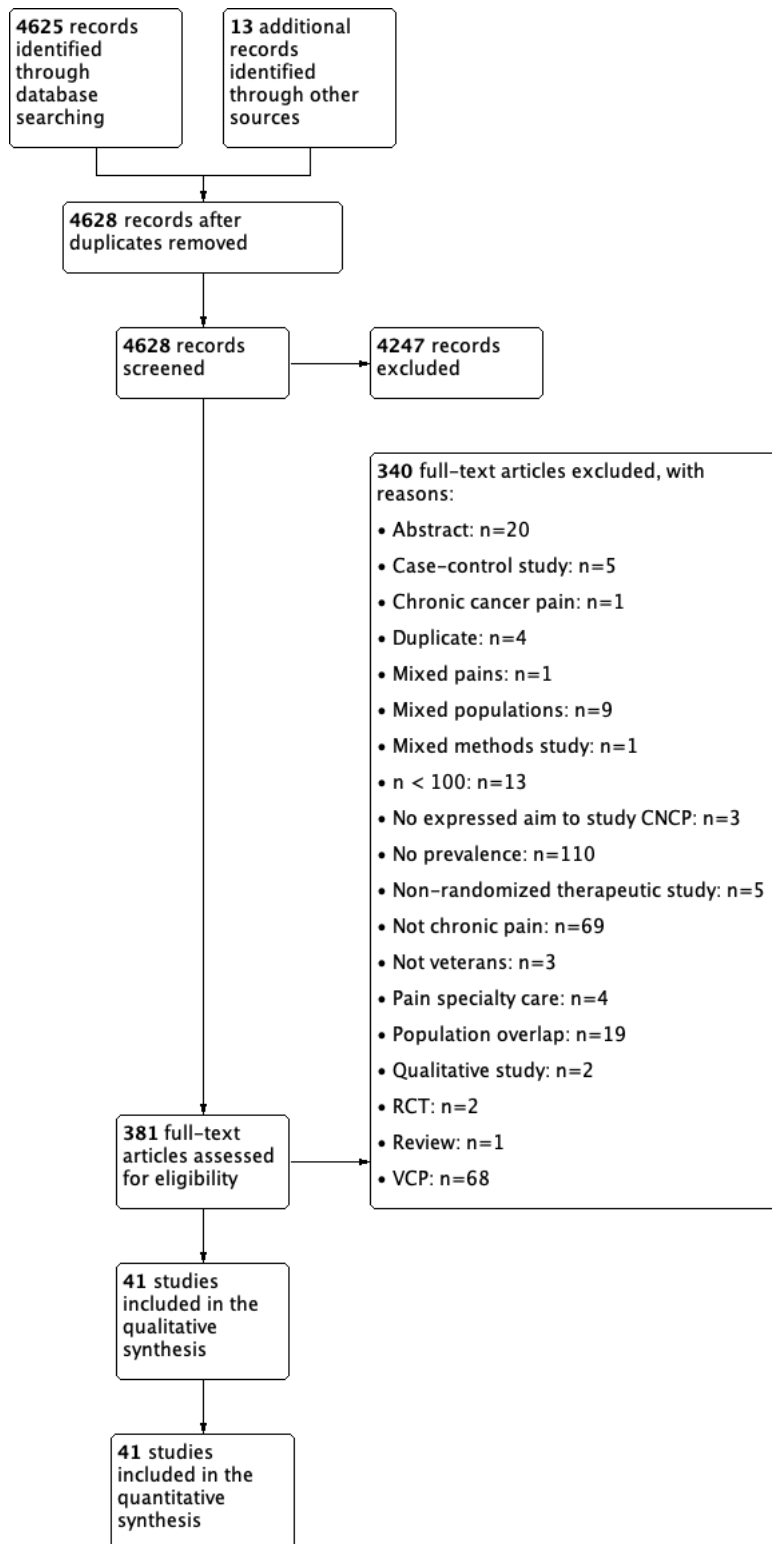
Publication bias was assessed through the visual inspection of a funnel plot, as well as using Begg's test.<sup>21</sup>

## **2.4. RESULTS**

### **2.4.1. Study characteristics**

Of 4,628 potentially eligible articles, 41 studies with 5,805,656 veterans met the eligibility criteria,<sup>22-62</sup> (**Figure 1; Supplementary Material 2 and 3**). From the prior review, six out of the eleven studies were eligible (**Supplementary Material 4**). There was near-perfect agreement between the two reviewers for full-text screening ( $\kappa = 0.83$ ). The median sample size was 3,150 (IQR = 458 – 116,913), and the median of the mean age was 54.8 years (IQR = 40.2 – 63.4 years). The median proportion of military veterans lost to follow-up was 6.81% (IQR = 0% - 31.7%). Five studies (12.2%)<sup>23,41,45,53,56</sup> clearly defined CNCP prevalence as pain persisting for  $\geq 3$  months. (**Supplementary Material 5**).





**Figure 1.** A flow chart of included and excluded studies.

### 2.4.2. Risk of bias

Most of the studies (29/41 or 70.7%) were at high risk of bias (ROB) for the representativeness of the sample to the general population,<sup>22,24-27,32,34-36,39-42,44-54,56,57,59-61</sup> mainly due to selective sampling of veterans with specific conditions or diseases. In particular, there was selective recruitment of veterans who underwent surgery,<sup>24,27,35,36,41,48,49,53</sup> veterans who had  $\geq 1$  musculoskeletal disorder(s),<sup>34</sup> and veterans with conditions that are associated with chronic pain,<sup>22,26,32,39,40,42,44-47,50,52,54,56,57,59-61</sup> such as alcohol use disorder,<sup>63</sup> depression,<sup>64</sup> Gulf war illness,<sup>65</sup> hepatitis C,<sup>66</sup> homelessness,<sup>67</sup> obstructive sleep apnea,<sup>68</sup> opioid therapy,<sup>69</sup> post-traumatic stress disorder,<sup>70</sup> schizophrenia,<sup>71</sup> sex,<sup>72</sup> spinal cord disorder or injury,<sup>73</sup> substance use disorder,<sup>74</sup> and traumatic brain injury<sup>70</sup>. Most of the studies (26/41 or 63.4%) also have a high ROB rating for the domain of outcome measurement validity.<sup>22,24-27,32,34-36,38,40-45,47-50,53,57,59-62</sup> More than half of the studies (23/41 or 56.1%) are at low ROB for the risk of under-reporting.<sup>22,23,25,26,28-31,37,39,43,45,46,48,51,52,55-60,62</sup> Majority of the studies (23/41 or 56.1%) had  $\leq 20\%$  missing data for CNCP, and hence were at low ROB for this domain, (**Supplementary Material 6**).<sup>23,25,26,29,30,33,34,36,38,40,41,42,44,47,48,50,51,53,54,57,59-61</sup>

### 2.4.3. Overall analysis

The pooled CNCP prevalence from 41 studies<sup>22-62</sup> is 34.2% (95% CI 24.5% 44.6%:  $n = 5,805,656$ ).

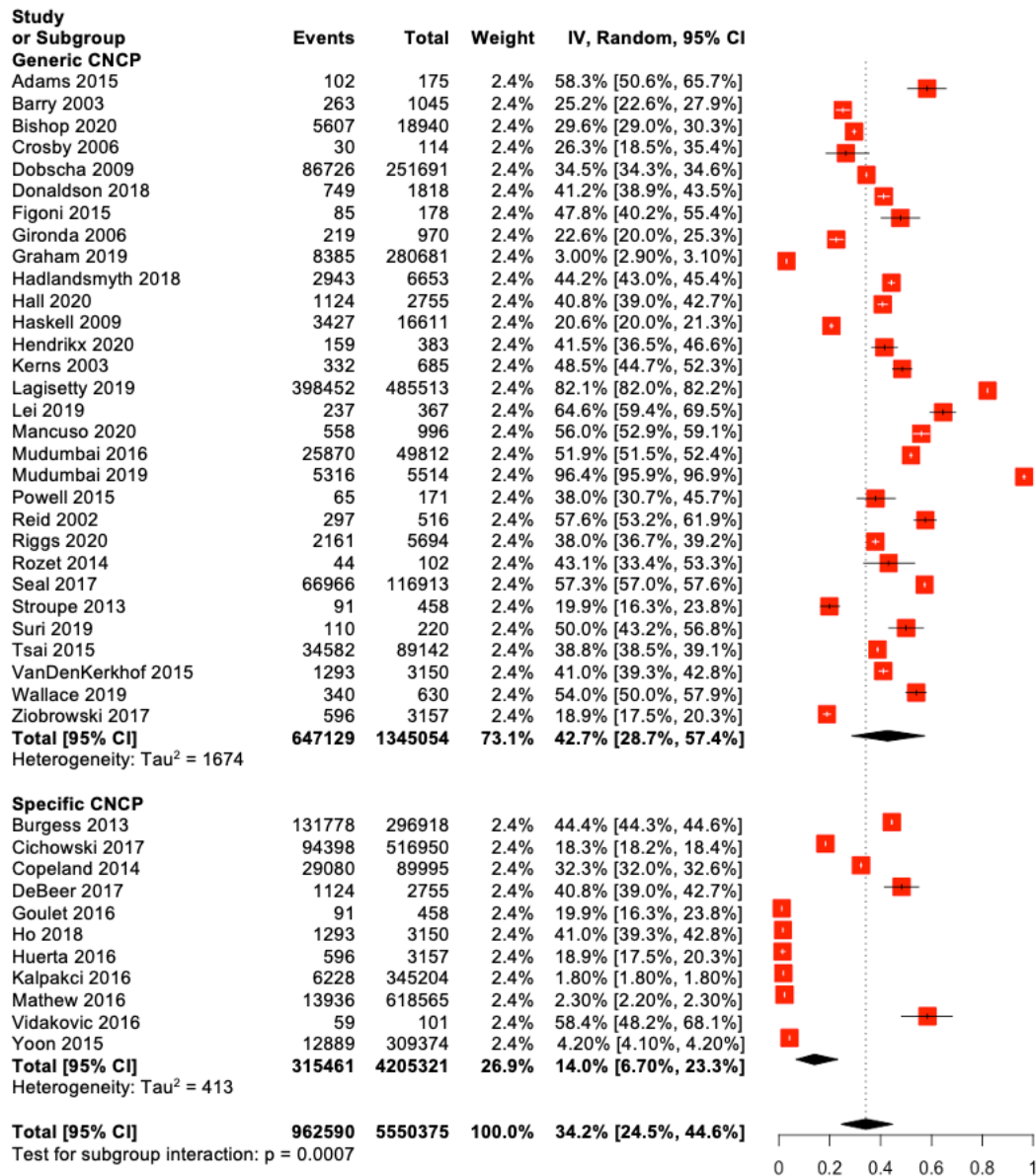
### 2.4.4. Subgroup analyses

#### 2.4.4.1. *A priori subgroup analyses*

There were no significant effects for subgroup differences with respect to sex, study size, any of the four ROB items, pain threshold, or pain reporting method (**Supplementary Materials 8-15**). The credibility of these *a priori* subgroup analyses was low (**Supplementary Material 7**).

#### **2.4.4.2. Post hoc subgroup analyses**

A significant subgroup effect was found for the type of CNCP prevalence measure used in the studies ( $p = 0.0007$ ). The credibility of the subgroup analysis was judged to be moderate, and hence the effects of the subgroups were considered, (**Supplementary Material 7**). Low quality evidence from 30 studies<sup>22-24,28,30-33,35-39,43-46,48-58,60,62</sup> citing a generic CNCP prevalence suggested a pooled CNCP prevalence of 42.7% (95% CI 28.7% to 57.4%;  $n = 1,345,054$ ). Moderate quality evidence from 11 studies<sup>25-27,29,34,40-42,47,59,61</sup> citing a specific CNCP prevalence suggested a pooled CNCP prevalence of 14.0% (95% CI 6.70% to 23.3%;  $n = 4,205,321$ ), (**Figure 2**).



**Figure 2.** Subgroup analysis of CNCP prevalence with respect to the type of CNCP prevalence measure. CI = confidence interval; CNCP = chronic non-cancer pain; IV = inverse variance.

### 2.4.4.3 Small-study effects

For the Generic CNCP prevalence subgroup, Begg’s test is statistically significant ( $p = 0.008$ ), and the funnel plot is asymmetric, (**Supplementary Material 16**). For the Specific CNCP prevalence subgroup, Begg’s test is *not* statistically significant ( $p = 0.1$ ), and the funnel plot is roughly symmetric (**Supplementary Material 17**).

**Table 1.** GRADE table with summary of findings.

Outcome	Analysis	No. of studies	Total No. of participants	Quality assessment						Summary of findings	
				Risk of bias	Inconsistency	Indirectness	Imprecision	Small-study effects	Overall quality of evidence	Absolute effect	
										Prevalence (%)	95% CI (%)
CNCP Prevalence	Prevalence Type: Generic	30	1,345,054	No serious risk of bias <sup>1</sup>	Serious inconsistency <sup>2</sup> ; $\tau = 40.9$	No serious indirectness <sup>3</sup>	No serious imprecision <sup>4</sup>	Detected; asymmetric funnel plot, Begg's test: $p = 0.008$ .	Low	42.8	28.7 – 57.4
CNCP Prevalence	Prevalence Type: Specific	11	4,205,321	No serious risk of bias <sup>1</sup>	Serious inconsistency <sup>2</sup> ; $\tau = 20.3$	No serious indirectness <sup>3</sup>	No serious imprecision <sup>4</sup>	Not detected; roughly symmetric funnel plot, Begg's test: $p = 0.1$ .	Moderate	14.0	6.71 – 23.3

\* GRADE = Grading of Recommendations, Assessment, Development and Evaluation; CNCP = Chronic non-cancer pain; 95% CI = 95% confidence interval; No. = Number.

GRADE is herein reported for only those analyses that have shown at least moderate credibility for subgroup effects, according to the Instrument for assessing the Credibility of Effect Modification Analyses (ICEMAN) criteria. Since the subgroup effects were credible, the pooled estimate from the overall analysis is not evaluated through GRADE.

<sup>1</sup> We did not rate down for risk of bias due to there being no significant subgroup differences for any of the four ROB items.

<sup>2</sup> We did rate down for inconsistency as the pooled estimate  $\pm 2 \tau$  created a very broad range for both subgroups. For the “Generic” subgroup,  $42.8\% \pm 2 * 40.9\% = 0\%$  to  $100\%$ , which is very broad. For the “Specific” subgroup,  $14.0\% \pm 2 * 20.3 = 0\%$  to  $54.6\%$ , which is also very broad.

<sup>3</sup> While the majority (>50%) of the studies did use a clinician-assessed method for CNCP prevalence, we did not rate down for indirectness due to there being no significant subgroup differences for pain reporting subgroup analysis.

<sup>4</sup> We did not rate down for imprecision as no threshold is specified, and we wished to not double count with any rating decisions for inconsistency.

#### **2.4.5. Meta-regression**

The random-effects meta-regression model using the predictor variable of proportion lost to follow-up and the dependent variable of CNCP prevalence was statistically significant ( $p = 0.001$ ,  $n = 35$  studies<sup>23,25,26,28-34,36-42,44,46-62</sup>), (**Supplementary Material 18 and 19**). For every 1% increase in proportion lost to follow-up, CNCP prevalence increases by 35.4% (95% CI 13.7% to 57.1%). After adding in type of prevalence measure, which is the only effect modifier with a statistically significant test of interaction, the random-effects meta-regression only found type of prevalence measure to be statistically significant in predicting CNCP prevalence ( $p < 0.0001$ ,  $n = 35$  studies<sup>23,25,26,28-34,36-42,44,46-62</sup>). The model estimates that, compared to the Generic CNCP prevalence subgroup, the Specific CNCP prevalence subgroup has a lower CNCP prevalence by 30.7% (95% CI 35.0% to 26.2%), (**Supplementary Material 19**).

#### **2.4.6. Sensitivity analysis**

A sensitivity analysis that used logit transformation pooled all 41 studies ( $n = 5,550,375$ )<sup>22-62</sup> and found a CNCP prevalence of 39.5% (95% CI 32.8% to 46.6%), (**Supplementary Material 20 and 21**).

### **2.5. DISCUSSION**

#### **2.5.1. Main findings**

Moderate quality evidence suggests that prevalence of subtypes of CNCP among military veterans is 14% (95% CI 6.7% to 57%). Low quality evidence suggests that the prevalence of CNCP in general among military veterans is 43% (95% CI 29% to 57%). For either subgroup, there was high variability, as all included studies were contained within a very broad range. After

adjusting for proportion lost to follow-up, type of CNCP prevalence measure remained as a significant predictor of CNCP prevalence.

Risk of bias, sex, pain threshold, pain reporting method and study size were not found to be credible effect modifiers for CNCP prevalence.

### **2.5.2. Relations to the literature and implications**

The prior systematic review posited a range of 25% to 72% for CNCP prevalence.<sup>9</sup> The present review however found a point estimate of general CNCP prevalence of 43%, and 14% for subtypes of CNCP prevalence. While the variability of the estimates in the former review spanned 47% (i.e., 72%-25% = 47%), our general CNCP prevalence estimates found a larger variation of 93% between studies of lowest and highest CNCP prevalence in the meta-analysis. Moreover, while our review adapted its search strategy from this prior review,<sup>9</sup> five studies in that review did not meet our eligibility criteria. It is likely that the range for CNCP prevalence from the prior review was distorted, as it included studies with prevalence measures for which acute and chronic pain could not be clearly differentiated, and studies that did not report a measure that was aimed at measuring CNCP prevalence.

Furthermore, the prior systematic review did not report a point estimate for CNCP prevalence,<sup>7</sup> while the meta-analysis herein found an estimate at roughly 43%. The prior review did not pool data due to variation in pain measurements.<sup>7</sup> However, we found that even features of the pain measurement such as the pain reporting method and threshold could not explain for the variation found in CNCP prevalence.

### **2.5.3. Strengths and limitations**

This review has several strengths. This is the first review to quantitatively examine CNCP prevalence via meta-analyses. Inherent variability in prevalence estimates was considered, and hence the Freeman-Tukey double arcsine transformation was used to stabilize the variance. Furthermore, this is the first review to quantitatively examine promising effect modifiers for explaining the variability in CNCP prevalence among military veterans. Moreover, a carefully selected eligibility criteria helped to isolate prevalence estimates that pertain to CNCP. In addition, given the distortion of the  $I^2$  from having large sample sizes per study,<sup>15-17</sup> visual inspection and  $\tau$  was used as the metric for examining heterogeneity. From this, we were able to comprehend the variability of the point estimates more accurately between studies. Finally, the eligibility criteria were broad enough such that it enhances the generalizability of the results to various samples of military veterans.

There are some limitations with this systematic review. Our meta-regression did not incorporate other variables that may be associated with CNCP prevalence, such as mental illness and age. Further, although there are other potential subgroup hypotheses we could have explored, we restricted our exploration of factors associated with between study variability to reduce the risk of spurious associations.<sup>19</sup>

#### **2.5.4. Future directions**

To retrieve a more precise pooled prevalence estimate of CNCP among military veterans, future studies pursuing this endeavor need to enhance their research methodology. CNCP should be measured in a representative sample using the definition from the International Association for the Study of Pain,<sup>1</sup> be patient-reported, and be systematically assessed in every participant recruited in the study. Furthermore, considering that nearly 30% of the studies in our review had



proportion of lost to follow up of  $\geq 20\%$ , surveying procedures need to ensure participant retention.

### **2.5.5. Conclusions**

Moderate quality evidence suggests that among military veterans, the prevalence of a given subtype of CNCP among military veterans is 14%. Low quality evidence suggests that the CNCP prevalence in general among military veterans is 43%. Methodologically robust studies are required to more precisely determine CNCP prevalence.

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## **2.7. SUPPLEMENTARY MATERIAL**

### **Supplementary Material 1. Eligible articles (n=41)**

1. Adams MH, Lovejoy TI, Turk DC, Dobscha SK, Hauser P, Morasco BJ. Pain-related anxiety mediates the relationship between depressive symptoms and pain interference in veterans with hepatitis C. *Gen Hosp Psychiatry* 2015;37(6):533–7.
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**Supplementary Material 2.** Studies excluded for Population Overlap (n=19)

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**Supplementary Material 3.** Baseline characteristics of the eligible studies ( $n = 41$ ).\*

Author	Year	Study Design	Country	Enrollment period	CNCP Prev.	Total eligible patients	Age mean $\pm$ SD / median (range)	Gender (%) Male	Population description	Race/Ethnicity <sup>†</sup>					
										White n (%)	Black n (%)	Hispanic n (%)	Asian n (%)	Other n (%)	Unk. (n%)
Adams	2015	PC	USA	NR	58.3%	175	56.2 (5.80)	93.0	VHA patients with Hepatitis C virus.	123 (70.0%)	25 (14.3%)	NR	NR	NR	NR
Barry	2003	CS	USA	2001	25.2%	1,045	75.4 (5.09)	84.1	VHA patients $\geq$ 65 years of age and are receiving primary care at the West Haven campus of the VA Connecticut Healthcare System.	236 (96.3%) §	NR	NR	NR	NR	NR
Bishop	2020	RC	USA	2006 – 2015	29.6%	16,612	NR	96.4	Veterans who underwent thoracic surgery, either thoracotomy or video assisted thoracoscopic surgery (VATS), at a VHA facility from January 1, 2006 through September 30, 2015.	12,766 (76.8%)	2,525 (15.2%)	NR	NR	NR	1,093 (6.58%)
Burgess	2013	CS	USA	2007	44.4%	542,422	NR	93.8	A sample of VA patients from the 2007 Survey of Health Care Experiences of Patients – ambulatory care module.	220,122 (40.6%)	25,382 (4.68%)	NR	NR	NR	51,414 (9.48%)
Cichowski	2017	RC	USA	1997 – 2017	40.9%	516,950	65.4 (18.3)	0.00	Veterans in the VHA with an alcohol use disorder diagnosis.	NR	NR	28,581 (5.53%)	NR	NR	51,813 (10.0%)
Copeland	2014	RC	USA	2005 – 2006	31.3%	179,990	63.4 (5.96)	95.4	VHA patients who experienced inpatient surgical treatment from fiscal year 2006 (FY2006; October 1, 2005, to September 30, 2006) to FY2009.	NR	NR	5,251 (5.83%)	NR	NR	NR
Crosby	2006	CS	USA	NR	26.3%	114	67.1 (3.06)	90.4	Veterans registered at two primary clinics in the Veterans Administration Western New York Healthcare System.	NR	NR	NR	NR	NR	NR
DeBeer	2017	PC	USA	NR	0.482%	224	36.6 (9.09)	66.1	Veterans who served in support of the wars in Iraq of Afghanistan after September 11, 2001.	132 (58.9%)	75 (33.5%)	NR	NR	NR	NR

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Dobscha	2009	RC	USA	2004 – 2005	34.5%	251,691	67.4 (0.424)	96.4	VHA patients who participated in the national VA survey of the Health Experiences of Patients (SHEP) for fiscal year 2005 (FY2005; October 1, 2004 to September 30, 2005).	215,979 (84.5%)	15,110 (5.91%)	11,033 (4.32%)	NR	8,187 (3.20%)	NR
Donaldson	2018	CS	USA	2015 – 2016	41.2%	1,850	38.7 (9.20)	90.2	Minnesota military veterans from the Readiness and Resilience in National Guard Soldiers study.	1,656 (89.5%)	NR	NR	NR	NR	NR
Figoni	2015	RC	USA	2013 & 2014	47.8%	178	64.0 (12.0)	94.0	Adult veteran outpatients with spinal cord injury (or disorder) referred for a kinesiotherapy wellness exercise program.	96 (53.9%)	52 (29.2%)	25 (14.0%)	NR	NR	NR
Gironda	2006	RC	USA	2001 – 2004	22.6%	970	31.4 (8.47)	93.0 ¶	Veterans of the Operations Enduring Freedom and Iraqi Freedom and are seeking treatment in a Southeastern VA medical center.	49 (60.0%)	15 (18.0%)	18 (22.0%)	NR	NR	NR
Goulet	2016	RC	USA	2001 – 2011	2.70%	5,237,853	NR	93.8	All veterans that have ≥1 musculoskeletal disorder diagnosis.	3,854,513 (72.9%)	804,834 (15.2%)	245,420 (4.64%)	NR	NR	NR
Graham	2019	RC	USA	2007 – 2014	2.99%	280,681	63.4 (11.6)	93.5	VHA patients undergoing non-cardiac inpatient surgery.	214,830 (76.5%)	49,257 (17.5%)	NR	NR	NR	11,484 (4.09%)
Hadlandsmyth	2018	RC	USA	2013 – 2015	44.2%	13,306	NR	93.0	Veterans who underwent total knee arthroplasty.	5,196 (78.1%)	929 (14.0%)	NR	NR	NR	384 (5.77%)
Hall	2020	CS	Canada	2016	40.8%	2,755	NR	87.6	Veterans that were released from the Canadian Regular Forces between 1998 and 2015.	NR	NR	NR	NR	NR	NR
Haskell	2009	RC	USA	2001 – 2008	20.6%	16,611	32.3 (0.0700)	87.9	Veterans who were discharged from the military from October 1, 2001 to November 30, 2007 and enrolled in VA services OR received VA care prior to January 1, 2008, made ≥1 VA visit	102,606 (67.0%)	24,732 (16.1%)	17,894 (11.7%)	NR	4,113 (2.68%)	3,867 (2.52%)

									in the year after their discharge.						
Hendrikx	2020	CS	UK	2015 – 2016	41.5%	383	NR	95.8	Veterans recruited from Combat Stress, the largest UK charity offering treatment to veterans seeking mental health support.	NR	NR	NR	NR	NR	NR
Ho	2018	CS	USA	2011 – 2012	1.61%	917,377	62.7 (6.28)	96.6	Veterans currently in treatment for cancer	NR	NR	NR	NR	NR	NR
Huerta	2016	RC	USA	2005 – 2015	18.9%	874	60.4 (12.4)	99.0	Veteran patients that underwent inguinal herniorrhaphy	638 (73.0%)	192 (22.0%)	44 (5.03%)	NR	NR	NR
Kalpakci	2018	RC	USA	2011 – 2012	1.80%	345,204	53.0	50.0	Veterans in VHA with a diagnosis of alcohol use disorder.	NR	77,703 (22.5%)	NR	NR	NR	NR
Kerns	2003	CS	USA	1996 – 1997	48.5%	685	65.6 (12.3)	96.5	Veterans from a primary care practice in the West Haven campus of the VA Connecticut Healthcare System.	NR	NR	NR	NR	NR	NR
Lagisetty	2019	RC	USA	2011 – 2014	82.1%	485,513	NR	91.9	VHA patients hospitalized between fiscal years 2011 and 2014 and had ≥1 prescription opioid medication filled through the VA pharmacy within 6 months before hospitalization.	355,894 (73.3%)	92,759 (19.1%)	25,205 (5.19%)	NR	NR	NR
Lei	2019	RC	USA	2013 – 2015	64.6%	367	62.7 (6.28)	90.1	Veterans who had a documented Gulf War Registry computerized medical record note between Jul 2013 and Jun 2015.	178 (48.5%)	67 (18.3%)	79 (21.5%)	47 (12.8%)	NR	NR
Mancuso	2020	CS	USA	2005 – 2008	56.0%	996	38.9 (5.95)	0.00	Female veterans enrolled in the VHA.	NR	NR	NR	NR	NR	NR
Mathew	2016	RC	USA	2011 – 2012	2.25%	618,565	54.5 (9.49)	90.6	All veterans who attended at least one outpatient visit during fiscal year 2012	NR	NR	NR	NR	NR	NR
Mudumbai	2016	RC	USA	2011	51.9%	49,812	NR	93.9	All VHA patients who underwent surgery in 2011	NR	NR	NR	NR	NR	NR
Mudumbai	2019	RC	USA	2010 – 2011	96.4%	5,514	NR	94.3	All VHA patients who underwent total knee	4,450 (80.7%)	929 (16.8%)	NR	44	65	NR

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									arthroplasty over one fiscal year across VHA hospitals nationwide.				(0.798 %)	(1.18 %)	
Powell	2015	CS	USA	NR	38.0%	171	33.3 (8.56)	86.5	Veterans enrolled in the Veterans Affairs Center of Excellence	117 (68.4%)	18 (10.5%)	29 (17.0%)	NR	NR	NR
Reid	2002	PC	USA	1997 – 1998	57.6%	1,290	NR	NR	Veterans enrolled in the primary care practice at VA Connecticut Healthcare System, West Haven, Connecticut.	NR	NR	NR	NR	NR	NR
Riggs	2020	PC	USA	2018	38.0%	5,694	55.1 (18.8)	89.6	Veterans who had received primary care at 1 of these Veterans Affairs medical centers and had a history of experiencing homelessness according to administrative data.	79 (1.39%)	2,225 (39.1%)	NR	NR	NR	NR
Rozet	2014	RC	USA	2007 – 2010	43.1%	102	38.9 (1.51)	87.6	Veterans who underwent ambulatory knee ambulatory surgery at VA Puget Sound Health Care System, which is a tertiary medical center.	105 (72.4%)	20 (13.8%)	NR	NR	11 (7.59 %)	9 (6.21 %)
Seal	2017	RC	USA	2007 – 2015	57.3%	183,879	32.0 (8.30)	93.5	Veterans who completed a Comprehensive Traumatic Brain Injury Evaluation and received a criterion standard diagnosis of TBI (none, mild, or moderate to severe).	70,235 (60.1%)	NR	NR	NR	NR	NR
Stroupe	2013	CS	USA	2008	19.9%	916	78.8 (3.41)	NR	Veterans from a midwestern VA medical center.	431 (94.1%)	NR	15 (3.28%)	NR	NR	NR
Suri	2019	PC	USA	2010 – 2012	50.0%	409	61.6 (1.67)	NR	Veterans from the Vietnam Era Twin Registry.	213 (93.8%)	NR	NR	NR	NR	NR
Tsai	2015	RC	USA	2007 – 2015	38.8%	81,046	47.1 (7.47)	100	Literally homeless and unstably housed male veterans with custody of minor children.	43,587 (53.8%)	33,854 (41.8%)	NR	NR	NR	NR
VanDenKerkh of	2015	CS	Canada	1998 – 2007	41.0%	3,154	44.0 (10.0)	88.0	Canadian Armed Forces Regular Force veterans released from service between 1998 and 2007.	NR	NR	NR	NR	NR	NR

Vidakovic	2016	CS	Croatia	2010	58.4%	101	47.2 (33.0)	100	Male war veterans with PTSD and depression.	101 (100%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Wallace	2019	RC	USA	2013	54.0%	630	52.0 (13.0)	14.8	Veterans with a diagnosis of obstructive sleep apnea at the Miami VAHS sleep center	NR	42 (6.7%)	32 (5.1%)	NR	NR	NR
Yoon	2015	CS	USA	2011 – 2012	7.38%	309,374	53.9 (9.39)	88.3	Veterans with major depressive disorder.	235,473 (76.1%)	60,184 (19.5%)	52,122 (16.8%)	NR	NR	NR
Ziobrowski	2017	CS	USA	2011	18.9%	3,157	NR	50.0	Veterans from the National Health and Resilience Study	2,638 (83.6%)	189 (5.99%)	152 (4.81%)	NR	NR	NR

\* TBI = Traumatic Brain Injury; VHA = Veterans Health Affairs; OEF/OIF/OND = Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn; VA = Veterans Affairs; VAMC = Veterans Affairs Medical Center; PTSD = Post-traumatic stress disorder; RC = Retrospective cohort study; CS = Cross-sectional study; PC = Prospective cohort study; USA = United States of American

† - Total, after combining independent subgroups that are *not* comprising fully/majorly of veterans that already have chronic pain.

‡ - Race/ethnicity data is often missing from a considerable number of veterans, and hence counts may underestimate the total eligible patients included in the study. The top six most predominant race/ethnicity categories are listed here.

§ The % is based on the number of patients with CNCP prevalence, and not the number of total patients.

¶ The *N* for race/ethnicity is 82.

**Supplementary Material 4.** Reasons for the exclusion of studies from the prior systematic review (n=5)

Study	Reason
Magruder 2012	The measured prevalence for pain cannot be clearly differentiated between acute vs chronic.
Seal 2012	The measured prevalence for pain cannot be clearly differentiated between acute vs chronic.
Haskell 2012	The measured prevalence for pain cannot be clearly differentiated between acute vs chronic.
Benedetto 1998	Did not report a measure that is aimed at measuring CNCP.
Leskinen 2010	Did not report a measure that is aimed at measuring CNCP.

**Supplementary Material 5.** Characteristics concerning the CNCP prevalence among eligible studies.\*

Study First Author and Year	Method of establishing presence of CNCP	Reporting Method	Threshold †	Chronic pain definition/criteria from the IASP <sup>‡</sup>		
				Persistence	Associated with emotional function and/or disability	Not mainly due to another condition
Adams 2015	The military veteran reports whether they have ever been diagnosed with a chronic pain condition and are currently experiencing pain using a self-report health measurement tool (exact tool not specified). Their answer to this question is confirmed using the electronic health record.	Clinician-Assessed	Low	No	No	No
Barry 2003	The military veteran reports whether in the previous 12 months, they have had chronic pain of a non-cancer cause for $\geq 3$ months.	Patient-Reported	Low	Yes	No	No
Bishop 2020	A military veteran would be classed as having chronic pain if they met one of the following criteria by Tian et al.: (i) Positive for $\geq 1$ ICD-9 code listed as “highly likely” to represent chronic pain. (ii) Positive for $\geq 2$ ICD-9 codes listed as “likely” to represent chronic pain. (iii) Positive for 1 ICD-9 code listed as “likely” to represent chronic pain and reported $\geq 2$ more scores that are $>4$ on a numeric pain rating scale.	Clinician-Assessed	Low	No	No	No

Burgess 2013	ICD-9 codes corresponding to chronic pain that the military veteran was positive for 2 years prior to their index visit.	Clinician-Assessed	Low	No	No	No
Copeland 2014	ICD-9 codes corresponding to a chronic pain condition.	Clinician-Assessed	Low	No	No	No
Cichowski 2017	ICD-9 codes corresponding to a chronic pain condition.	Clinician-Assessed	Low	No	No	No
Crosby 2006	Military veterans reported via a survey questionnaire as to whether they “always” had chronic pain at $\geq 1$ site.	Patient-Reported	Low	No	No	No
DeBeer 2017	Military veterans reported via a chronic pain screening questionnaire as to whether they had chronic pain. The chronic pain assessed was musculoskeletal pain.	Patient-Reported	Low	No	No	No
Dobscha 2009	Military veterans reported whether they received chronic pain treatment in the past 12 months.	Patient-Reported	Low	No	No	No
Donaldson 2018	Utilized the National Pain Strategy population health pain persistence item, which has 5 possible responses. Defined "Chronic pain" as the presence of pain on at least half the days in the previous 6 months.	Patient-Reported	Low	Yes	No	No
Figoni 2015	“Chronic pain” is listed in the electronic medical record for the military veteran.	Clinician-Assessed	Low	No	No	No
Gironda 2006	Military veterans reported during a medical visit as to whether they had moderate or severe chronic pain intensity.	Patient-Reported	High	No	No	No
Goulet 2016	ICD-9 codes corresponding to a musculoskeletal disorder (e.g., fibromyalgia).	Clinician-Assessed	Low	No	No	No
Graham 2019	ICD-9 codes corresponding to a history of chronic pain.	Clinician-Assessed	Low	No	No	No
Hadlandsmyth 2018	To determine chronic pain, the military veteran had to meet one of the following criteria by Tian et al. was applied in the year prior to total knee arthroscopy: (i) Positive for $\geq 1$ ICD-9 code listed as “highly likely” to represent chronic pain. (ii) Positive for $\geq 2$ ICD-9 codes listed as “likely” to represent chronic pain, and these positive results are separated by $\geq 30$ days. (iii) Positive for 1 ICD-9 code listed as “likely” to represent chronic pain and reported $\geq 2$ more scores that are $>4$ on a numeric pain rating scale. (iv) Received opioid medication for $\geq 90$ days. (v) Positive for 1 ICD-9 code listed as “likely” to represent chronic pain and reported $\geq 2$ more scores that are $>4$ on a numeric pain rating scale.	Clinician-Assessed	Low	No	No	No
Hall 2020	Chronic pain is determined by the military veteran by indicating that the pain prevents few (level 3), some (level 4)	Patient-Reported	Low	No	Yes	No



	or most (level 5) activities. The pertinent question on the Life After Service Survey is “How many activities does your pain or discomfort prevent?”. This question uses a 5-level scale. If a patient indicates “few”, “some” or “most” activities for this question, then they are determined to have chronic pain.					
Haskell 2009	Military veterans reported whether they have persistent pain, which is defined as scoring $\geq 4$ in $\geq 3$ pain scores on a numeric pain rating scale, in three different months. This is only assessed in military veterans that scored $\geq 1$ on the numeric pain rating scale and have their data is available for $\geq 3$ pain scores.	Patient-Reported	Low	No	No	No
Hendrikx 2020	The military veteran indicates the presence of 14 physical health complaints using the National Health Institute screening tool, with one of the physical health complaints being “Chronic pain”.	Patient-Reported	Low	No	No	No
Ho 2018	ICD-9 codes corresponding to a chronic pain condition.	Clinician-Assessed	Low	No	No	No
Huerta 2016	Inguinodynia was defined as having pain lasting for $\geq 3$ months after heniorrhaphy.	Clinician-Assessed	Low	Yes	No	No
Kalpakci 2018	ICD-9 codes corresponding to a pain diagnosis (e.g., fibromyalgia).	Clinician-Assessed	Low	No	No	No
Kerns 2003	Military veterans were asked two questions using the self-report Health-Risk Behavior Screening Questionnaire. A “yes” response must be given to both questions: (i) “Do you experience pain on a regular basis?” (ii) “Is this a concern to you?”	Patient-Reported	Low	No	No	No
Lagisetty 2019	ICD-9 codes corresponding to a chronic pain condition.	Clinician-Assessed	Low	No	No	No
Lei 2019	The military veteran’s medical record explicitly lists them having pain lasting for $\geq 3$ months.	Clinician-Assessed	Low	Yes	No	No
Mancuso 2020	Patients were asked via an interview as to whether they had ever been diagnosed for fibromyalgia or other chronic pain.	Patient-Reported	Low	No	No	No
Mathew 2016	ICD-9 codes corresponding to a chronic pain condition.	Clinician-Assessed	Low	No	No	No
Mudumbai 2016	$\geq 2$ pain diagnoses that are in the year before admission for surgery and are at least 90 days apart and are recorded in the in-patient or out-patient file.	Clinician-Assessed	Low	No	No	No
Mudumbai 2019	$\geq 2$ pain diagnoses that are in the year before admission for total knee arthroscopy and are at least 90 days apart and are recorded in the in-patient or out-patient file, and of which one of the diagnoses comes from an in-patient visit within that time period.	Clinician-Assessed	High: diagnosis <i>also</i> has a condition of it being from an in-patient visit	No	No	No

			within the time period.			
Powell 2015	Chronic pain is defined as pain lasting for $\geq 3$ months. The diagnosis of chronic pain was determined by one of three assessments: (1) The military veteran had to have chronic pain listed as an active problem in their Centralized Patient Record System on a date prior to the day that they are being assessed at the Translational Research Center for TBI and Stress Related Disorders. (2) A psychological consensus results in the military veteran being referred to a chronic pain specialist. (3) During a psychological interview, the military veteran discusses pain that has lasted for more than 3 months.	Clinician-Assessed	Low	Yes	No	No
Reid 2002	The military veteran answered the following question on a brief, self-administered questionnaire, and had to give an answer of “constant”: - “Would you best describe your pain as (circle one) intermittent or constant?”	Patient-Reported	Low	No	No	No
Riggs 2020	“Severe chronic pain” is defined as indicating “yes” for chronic pain and rating current pain at a score of $\geq 7$ on a 10-point numeric rating scale. A duration requirement for “Severe chronic pain” is not specified.	Patient-Reported	High: requires chronic pain to be “severe”.	No	No	No
Rozet 2014	Chronic post-operative pain was identified using the surrogate outcome of prolonged post-operative opioid prescription (PPOP). PPOP was defined as opioids being prescribed for $\geq 3$ months after knee arthroscopy.	Clinician-Assessed	Low	No	No	No
Seal 2017	$\geq 2$ of the same pain diagnoses $\geq 90$ days apart, before or 1 year after the CTBIE. The specific pain diagnosis is identified using ICD-9-CM codes.	Clinician-Assessed	Low	No	No	No
Stroupe 2013	A question on the mailed survey asks the military veteran to indicate the status of eight health conditions, of which one of them is “Chronic pain”.	Patient-Reported	Low	No	No	No
Suri 2019	Military veterans reported via a survey as to whether they ever had “chronic back pain” in the past for $\geq 3$ months.	Patient-Reported	Low	Yes	No	No
Tsai 2015	Military veteran is asked whether a doctor or nurse has ever told them that they had a list of medical conditions, with “Chronic pain” being one of the medical conditions.	Clinician-Assessed	Low	No	No	No
VanDenKerkhof 2015	Constant or reoccurring pain or discomfort that is confirmed to be present by responding “yes” to both of the following questions from the 2010 Survey on Transition to Civilian Life:	Patient-Reported	Low	No	No	No

	(1) Do you have any pain or discomfort that is always present? (yes/no) (2) Do you have any pain or discomfort that reoccurs from time to time? (yes/no)					
Vidakovic 2016	To determine whether the military veteran has a diagnosis of myofascial pain syndrome, the clinician studied amnestic history (which included variables such as the pain’s duration, intensity, location, and type), and conducted a detailed clinical examination.	Clinician-Assessed	High: Must go through multiple strands of evidence (e.g., amnestic history, clinical exams) to determine the diagnosis of chronic pain.	No	No	No
Wallace 2019	Chronic pain is diagnosed by the sleep physician through one of two ways: (1) The military veteran is prescribed medication for pain complaints for $\geq 6$ months preceding diagnostic polysomnography (2) The military veteran is attending the Miami Veterans Affairs Health Services Pain clinic in the 12 months prior to undergoing their diagnostic polysomnography.	Clinician-Assessed	High: $\geq 6$ months as opposed to $\geq 3$ months for the duration.	No	No	No
Yoon 2015	ICD-9 codes corresponding to a chronic pain condition.	Clinician-Assessed	Low	No	No	No
Ziobrowski 2017	Military veteran is asked “Has a doctor or health care professional ever told you that you have any of the following medical conditions?”, with “Chronic pain” being one of the medical conditions.	Clinician-Assessed	Low	No	No	No

\* CNCP = Chronic non-cancer pain; CTBIE = Comprehensive Traumatic Brain Injury Evaluation; ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; TBI = Traumatic Brain Injury.

† High threshold corresponds to a study that adds criteria for defining CNCP prevalence that make it more difficult to establish its presence; such criteria goes beyond  $\geq 3$  months of persistent pain, simply asking patients if they have chronic pain, or retrieving this information from medical records or ICD-9 codes.

‡ Retrieved from the IASP’s definition of chronic primary pain.

**Supplementary Material 6.** Reasoning for ROB item ratings for each included study in the quantitative synthesis (n=41).\*

Study	RB1 Rating	RB1 Explanation	RB2 Rating	RB2 Explanation	RB3 Rating	RB3 Explanation	RB4 Rating	RB4; Amount of missing data †
Adams 2015	High	To be eligible, all patients must have Hepatitis C, which is associated with chronic pain. <sup>65</sup>	High	Instead of asking patients directly, they used an electronic medical record to confirm the diagnosis of CNCP prevalence.	Low	All military veterans were systematically asked through a survey whether they have chronic pain.	High	NR
Barry 2003	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether or not they had CNCP.	Low	Patients were systematically screened for the presence of CNCP.	Low	8.65%
Bishop 2020	High	Selectively recruited military veterans who underwent thoracic surgery.	High	2/3 of the methods for diagnosing chronic pain were determined using ICD-9 codes. The remaining 1 method was through patient reporting $\geq 2$ scores indicating greater than mild pain $\geq 4$ on a numeric rating scale.	High	Data on chronic pain was retrieved from electronic medical records for all 3 methods of data collection, and it is not certain that every military veteran was systematically asked about CNCP prevalence.	High	NR
Burgess 2013	High	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	High	Diagnoses of CNCP were determined using ICD-9 codes.	Low	Data retrospectively retrieved from survey that directly asked military veterans about CNCP prevalence.	Low	0.668%
Cichowski 2017	High	Selectively recruited female military veterans; sex differences have previously been shown for chronic pain. <sup>71</sup>	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	8.90%
Copeland 2014	High	Selectively recruited military veterans who received inpatient surgical treatment.	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	High	NR
Crosby 2006	Low	Majority of the military veterans do not have any condition(s) that is/are	Low	Patients reported whether or not they had constant pain.	Low	All military veterans were systematically asked through	High	24.0%

		associated with chronic pain.				a survey as about constant pain.		
DeBeer 2017	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether or not they have chronic pain.	Low	All military veterans were systematically asked through a survey whether they have chronic pain through a chronic pain screening questionnaire.	Low	10.4%
Dobscha 2009	Low	Data retrospectively retrieved from survey that directly asked military veterans about CNCP prevalence.	Low	Patients reported whether or not they received treatment for chronic pain in the VA in the previous 12 months.	Low	Data retrospectively retrieved from survey that directly asked military veterans whether they were receiving treatment for chronic pain.	Low	1.50%
Donaldson 2018	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether or not they had chronic pain.	Low	All military veterans were systematically asked through a survey whether they have chronic pain.	High	53.2%
Figoni 2015	High	To be eligible, all patients must have spinal cord injury or spinal cord disorder, which is known to be associated with chronic pain. <sup>72</sup>	High	Instead of asking patients directly, they used an electronic medical record to confirm the diagnosis of chronic pain.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	High	0
Gironda 2006	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether or not they had chronic pain.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	2.16%
Goulet 2016	High	Selectively recruited military veterans with a musculoskeletal disorder diagnosis.	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Graham 2019	High	Selectively recruited military veterans that are undergoing non-cardiac inpatient surgery.	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from administrative databases and so it is not certain that every military	High	NR

						veteran was systematically asked about CNCP prevalence.		
Hadlandsmyth 2018	High	Selectively recruited military veterans that underwent total knee arthroplasty.	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from administrative databases and so it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	6.81
Hall 2020	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether or not they had chronic pain.	Low	All military veterans were systematically asked through a survey whether they have chronic pain.	High	33.1
Haskell 2009	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	High	“Persistent pain” is subjective and so we are less confident that they are directly referring to chronic pain.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	18.2
Hendrikx 2020	High	Majority (86%) of the patients have PTSD, which is associated with chronic pain. <sup>60</sup>	Low	Patients reported whether or not they had chronic pain.	Low	All military veterans were systematically asked through a survey whether they have chronic pain.	High	42.2
Ho 2018	High	Selectively recruited for military veterans with substance use disorder, which is associated with chronic pain. <sup>73</sup>	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from administrative databases and so it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Huerta 2016	High	Selectively recruited military veterans that underwent inguinal herniorrhaphy (i.e., a specific type of surgery).	High	A clinician reported whether or not the patient had a diagnosis of chronic post-operative pain (inguinodynia in this case).	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Kalpakci 2018	High	Selectively recruited military veterans with an alcohol use disorder diagnosis, which is	High	Diagnoses of chronic pain were determined using ICD-9 codes.	High	Data on chronic pain was retrieved from administrative databases and so it is not certain that every military	Low	0

		associated with chronic pain. <sup>62</sup>				veteran was systematically asked about CNCP prevalence.		
Kerns 2003	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	High	“Regular pain” is subjective and so we are less confident that they are directly referring to chronic pain.	Low	All military veterans were systematically asked through a survey whether they experience regular pain and if it’s a concern to them on a regular basis.	High	NR
Lagisetty 2019	High	The study selectively recruited for military veterans with $\geq 1$ prescription opioid medication from a VA pharmacy 6 months prior to their hospitalization.	High	Diagnoses of chronic pain was determined using ICD-9 codes.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	1.07%
Lei 2019	High	Majority of the military veterans in the sample have Gulf War illness (GWI; $\geq 3/6$ GWI symptoms), which is associated with chronic pain. <sup>64</sup>	High	A clinician reviews the Gulf War registry computerized note and reports whether there is a diagnosis of chronic pain.	High	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	High	NR
Mancuso 2020	High	Selectively recruited female military veterans; sex differences have previously been shown for chronic pain. <sup>71</sup>	High	Patients reported if they were ever diagnosed for chronic pain; hence, it was not themselves that reported if they had chronic pain.	Low	Data retrospectively retrieved from study interviews that systematically asked military veterans to report whether they had ever been diagnosed with chronic pain.	High	58.7%
Mathew 2016	High	Selectively recruited for military veterans with an ICD-9 diagnosis of schizophrenia, which includes schizoaffective disorder, bipolar disorder, or major depressive disorder, and is associated with chronic pain. <sup>70</sup>	High	Diagnosis of chronic pain (i.e, fibromyalgia) was determined using ICD-9 codes.	High	Data on chronic pain was retrieved from administrative databases and so it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Mudumbai 2016	High	Study selectively recruited military veterans that underwent surgery in 2011.	High	Instead of asking patients directly, they used outpatient or inpatient files to confirm the diagnosis of chronic pain.	Low	Data on chronic pain was retrieved from outpatient and inpatient files and it is not certain that every military veteran was systematically	Low	6.34%

						asked about CNCP prevalence.		
Mudumbai 2019	High	Selectively recruited for military veterans that underwent total knee arthroplasty.	High	Diagnoses of chronic pain was determined using ICD-9 codes.	High	Data on chronic pain was retrieved from electronic medical records and so it is not certain that every military veteran was systematically asked about CNCP prevalence.	High	47.8%
Powell 2015	High	Majority (68%) of the patients have $\geq 1$ TBI, which is associated with chronic pain. <sup>69</sup>	High	Most of the diagnoses for chronic pain (95% or 62/65) occurred through the assessment of clinicians.	High	Most of the data on chronic pain was retrieved from the centralized patient record system, and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	3.39%
Reid 2002	High	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether they have “constant pain”.	Low	All military veterans were systematically asked through a survey whether they have “constant pain”.	Low	19.5%
Riggs 2020	High	Majority (56%) of the patients have Depression, which is associated with chronic pain. <sup>63</sup>	Low	Patients reported whether they have “severe chronic pain”.	Low	All military veterans were systematically asked through a survey whether they have “severe chronic pain”.	High	59.5%
Rozet 2014	High	Selectively recruited military veterans that underwent elective knee arthroscopy.	High	The surrogate of prolonged post-operative opioid prescription was used to indicate a diagnosis of chronic post-operative pain.	High	Data on chronic pain was retrieved from electronic medical records and so it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Seal 2017	High	Majority (66%) of the patients have PTSD and at least mild TBI, which are both known to be associated with chronic pain. <sup>69</sup>	Low	Diagnoses of chronic pain was determined using ICD-9 codes.	High	Data on chronic pain diagnoses was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	12.8%
Stroupe 2013	Low	Majority of the military veterans do not have any condition(s) that are known to be associated with chronic pain.	Low	Patients reported whether or not they had chronic pain.	Low	All military veterans were systematically asked through a survey as to whether they had chronic pain.	High	42.0%



Suri 2019	High	Study selectively recruited male military veterans.	Low	Patients reported whether they had “any chronic low back pain”.	Low	All military veterans were systematically asked through a survey as to whether they had “any chronic low back pain”.	High	35.7%
Tsai 2015	High	Majority of the patients in the study are homeless, which is a factor that is associated with chronic pain. <sup>66</sup>	High	Patients reported if a physician ever told them that they have chronic pain, and hence chronic pain prevalence is not reported by patients directly.	Low	Data retrospectively retrieved originated from a structured form that asked military veterans about chronic pain.	Low	0
VanDenKerkhof 2015	Low	Majority of the military veterans do not have any condition(s) that is/are associated with chronic pain.	Low	Patients reported whether they had “constant pain”.	Low	All military veterans were systematically asked through a survey as to whether they had “constant pain”.	High	33.2%
Vidakovic 2016	High	Selectively recruited military veterans that have PTSD and depression, both of which are associated with chronic pain. <sup>63,69</sup>	High	The examining clinician reported whether or not military veterans had chronic myofascial syndrome.	Low	All military veterans underwent a detailed clinical examination to determine whether they had chronic pain (chronic myofascial syndrome in this case).	Low	0
Wallace 2019	High	To be eligible, all patients must have obstructive sleep apnea, which is associated with chronic pain. <sup>67</sup>	High	Chronic pain diagnosis was determined indirectly through medication prescription or attendance to a pain clinic.	Low	Data on chronic pain was retrieved from electronic medical records and it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Yoon 2015	High	Selectively recruited military veterans that had an ICD-9 diagnosis of major depressive disorder, which is associated with chronic pain. <sup>63</sup>	High	Diagnoses of chronic pain was determined using ICD-9 codes.	High	Data on chronic pain was retrieved from administrative databases and so it is not certain that every military veteran was systematically asked about CNCP prevalence.	Low	0
Ziobrowski 2017	Low	Majority of the military veterans do not have any condition(s) that are known to be associated with chronic pain.	High	Patients reported if a physician or healthcare professional ever told them that they have chronic pain, and hence chronic pain prevalence is not reported by patients directly.	Low	Data retrospectively retrieved originated from a survey that asked military veterans about chronic pain.	High	30.3%

\* RB1 = Representativeness to the study sample to the study population; RB2 = Outcome measurement validity; RB3 = Risk of under-reporting; CNCP = Chronic non-cancer pain.

† If a study excluded data but failed to report how many individuals were excluded, then a high ROB rating was given, and “NR” is written instead of a percentage. For all studies that lost  $\geq 20\%$  of missing data, a high ROB rating was given, and low ROB rating if otherwise.

**Supplementary Material 7. ICEMAN assessment of the credibility of subgroup analyses.\***

Subgroup analysis	Criteria									Overall credibility rating
	1 Is the analysis of effect modification based on comparison within rather than between studies?	2 For within-trial comparisons, is the effect modification similar from study to study?	3 For between-study comparisons, is the number of trials large? †	4 Was the direction of effect modification correctly hypothesized <i>a priori</i> ?	5 Does a test of interaction suggest that chance is an unlikely explanation of the apparent effect modification?	6 Did the authors test only a small number of effect modifiers or consider the number in their statistical analysis?	7 Did the authors use a random effects model?	8 If the effect modifier is a continuous variable, were arbitrary cut-points avoided?	9 Are there any additional considerations that may increase or decrease credibility?	
Study size	Completely between	Not applicable	Large (17 studies)	Definitely yes ‡	Chance a very likely explanation (p = 0.2)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low
Pain reporting	Completely between	Not applicable	Large (16 studies)	Definitely yes ‡	Chance a very likely explanation (p = 0.4)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low
Threshold	Completely between	Not applicable	Rather large (5 studies)	Definitely yes ‡	Chance a very likely explanation (p = 0.2)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low
Representativeness of study population (ROB Item 1)	Completely between	Not applicable	Large (12 studies)	Definitely yes ‡	Chance a very likely explanation (p = 0.6)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Effect modification supported by external evidence <sup>62-73</sup>	Low
Validity of outcome measure (ROB Item 2)	Completely between	Not applicable	Large (15 studies)	Definitely yes ‡	Chance a very likely explanation (p = 0.3)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low
Risk of under-reporting (ROB Item 3)	Completely between	Not applicable	Large (18 studies)	Definitely yes ‡	Chance a likely explanation (p = 0.05)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low

Missing data (ROB Item 4)	Completely between	Not applicable	Large (18 studies)	Definitely yes ‡	Chance a very likely explanation (p = 0.2)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low
Sex	Completely within	Probably not similar or unclear	Not applicable	Definitely yes ‡	Chance a very likely explanation (p = 0.8)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Low
Loss to follow-up (meta-regression)	Completely between	Not applicable	Rather large (35 studies)	Definitely yes ‡	Chance an unlikely explanation (p = 0.001)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Not applicable	Moderate
Prevalence Measure Type	Completely between	Not applicable	Large (11 studies)	Definitely yes §	Chance an unlikely explanation (p = 0.0007)	Probably no (10 effect modifiers)	Definitely yes	Not applicable	Effect modification supported by external evidence #	Moderate

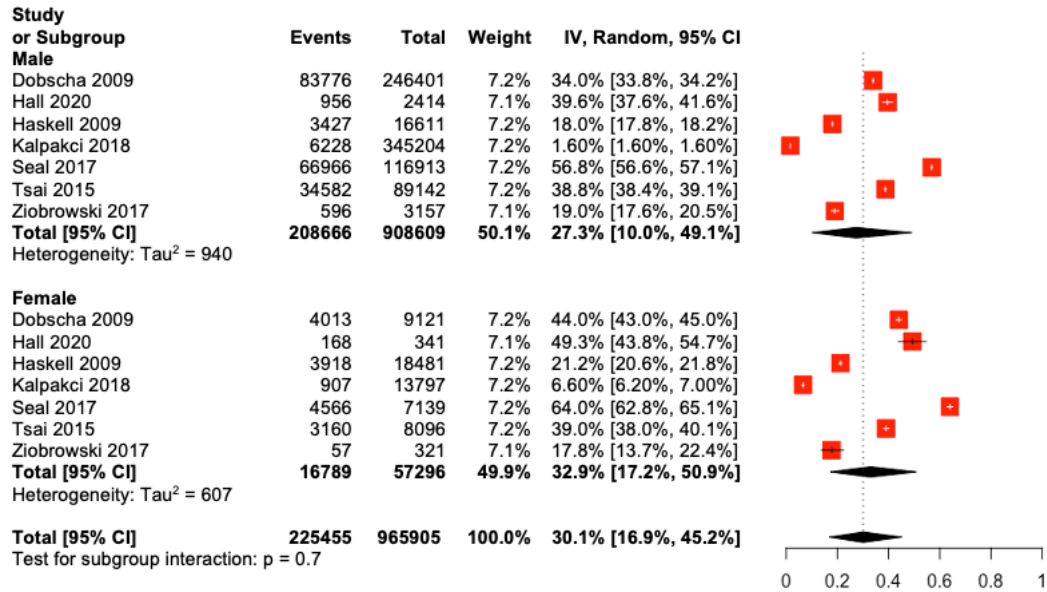
\* ICEMAN – Instrument for assessing the Credibility of Effect Modification Analyses; ROB = Risk of bias. Two items that definitely decrease the credibility are given a “Low” rating. If all of the items definitely decrease credibility, a “Very low” rating is given. Additional considerations (Item 9) may either increase or decrease the credibility of the effect modifier.

† The number of studies in the parentheses corresponds to the number of studies in the *smallest* subgroup for a given effect modifier.

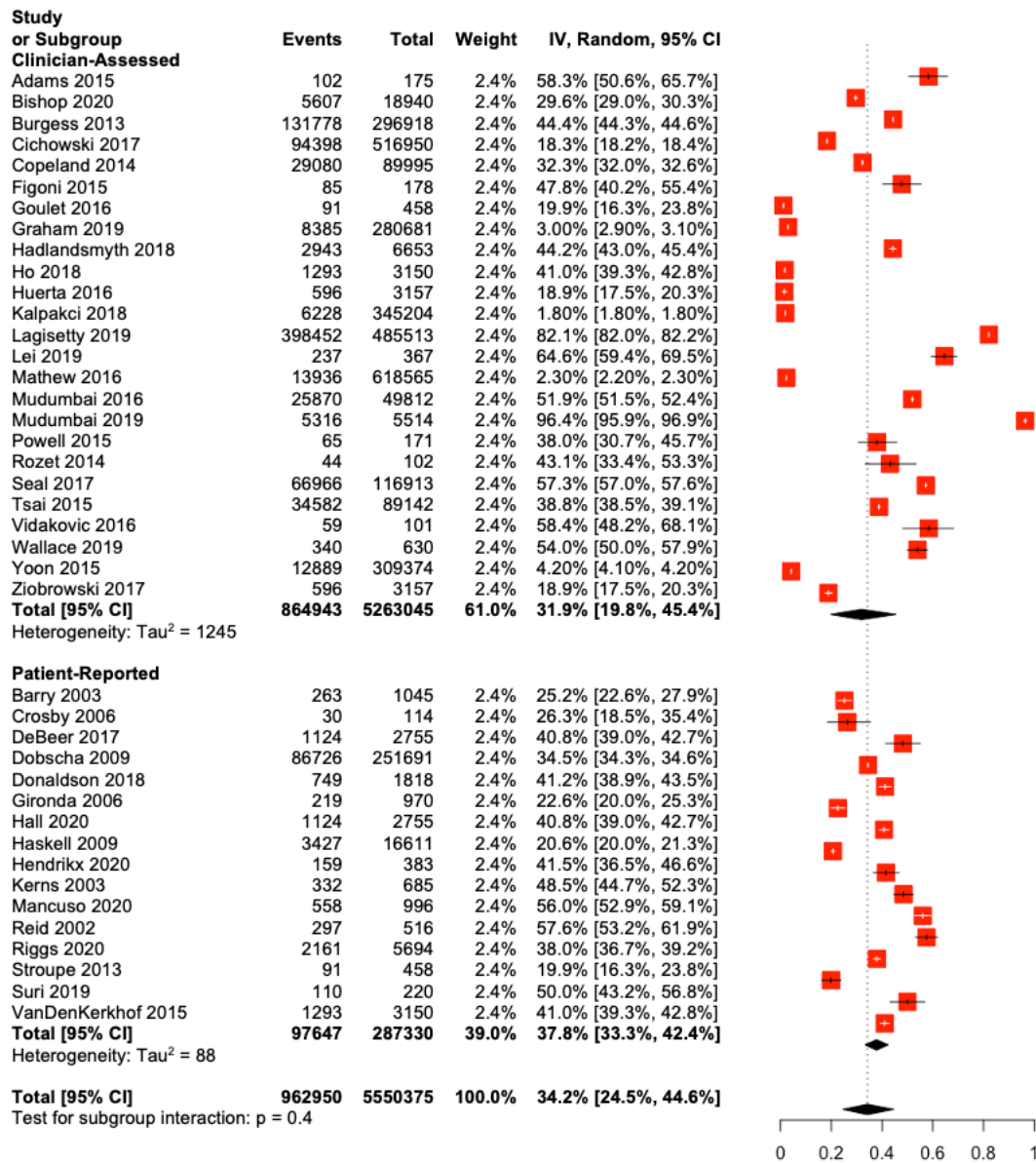
‡ These effect modifiers were all hypothesized *a priori* via the study protocol, which is published in the Open Science Framework (<https://osf.io/pgukx>)

§ This effect modifier overlaps with the representativeness of the sample to the general population. Studies in which a specific form of pain is being studied are less likely to be representative of the general population of military veterans.

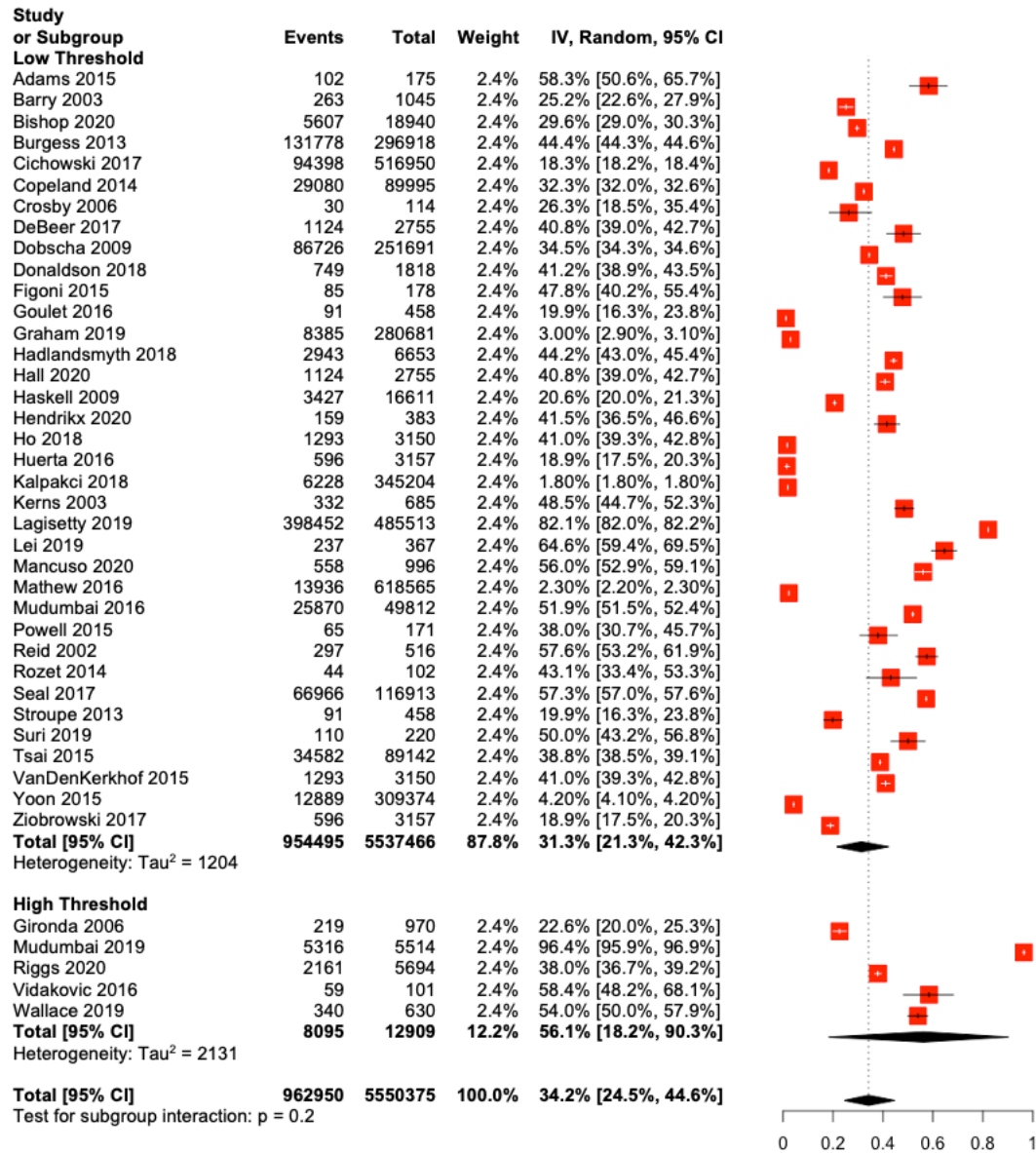
# When exploring the proportion (prevalence) of a subset of chronic pain, it should be less than the whole range of chronic pain t



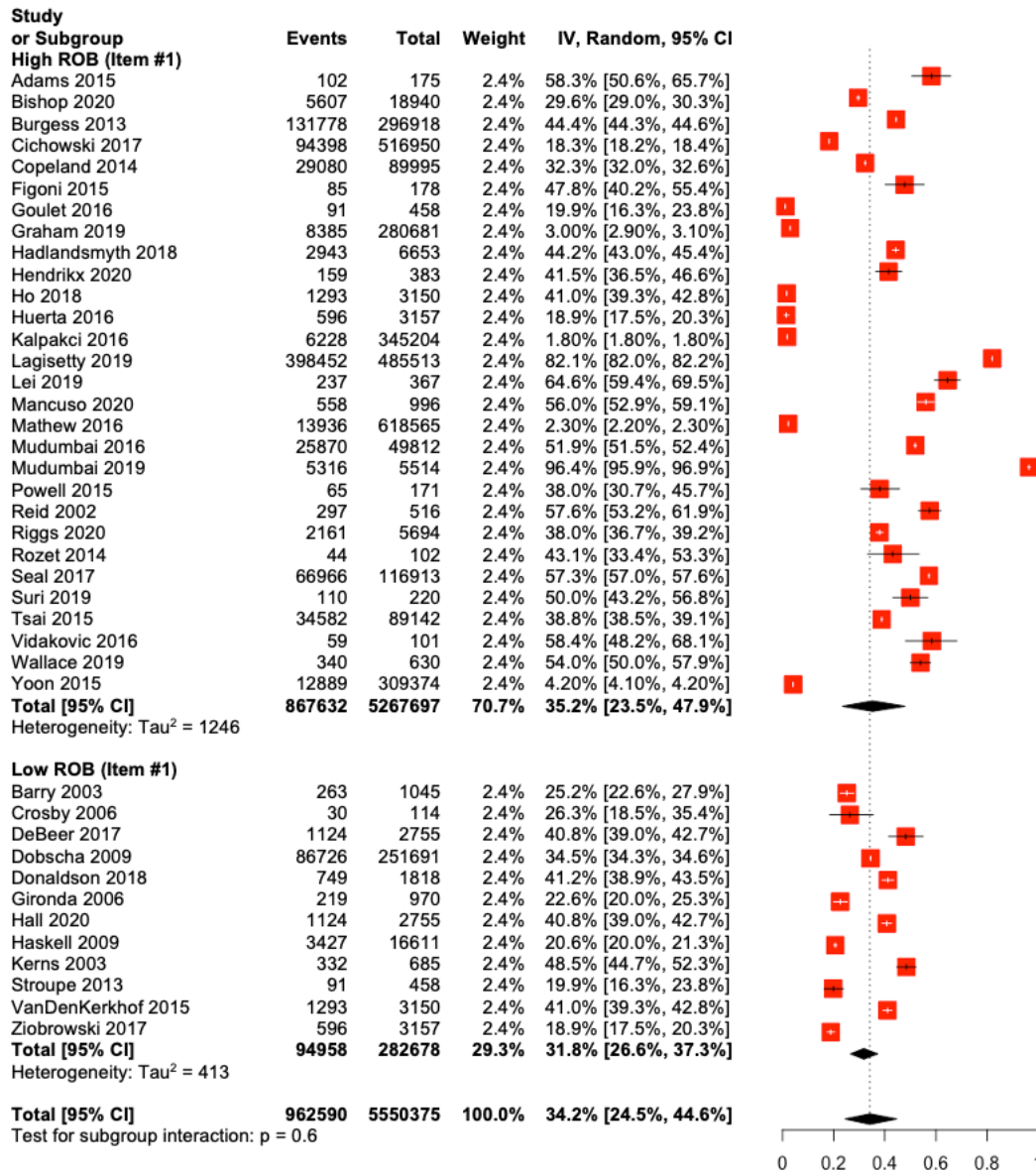
**Supplementary Material 8.** Subgroup analysis of chronic non-cancer pain prevalence with respect to sex. CI = confidence interval; IV = inverse variance.



**Supplementary Material 9.** Subgroup analysis of chronic non-cancer pain prevalence with respect to pain reporting method. CI = confidence interval; IV = inverse variance.

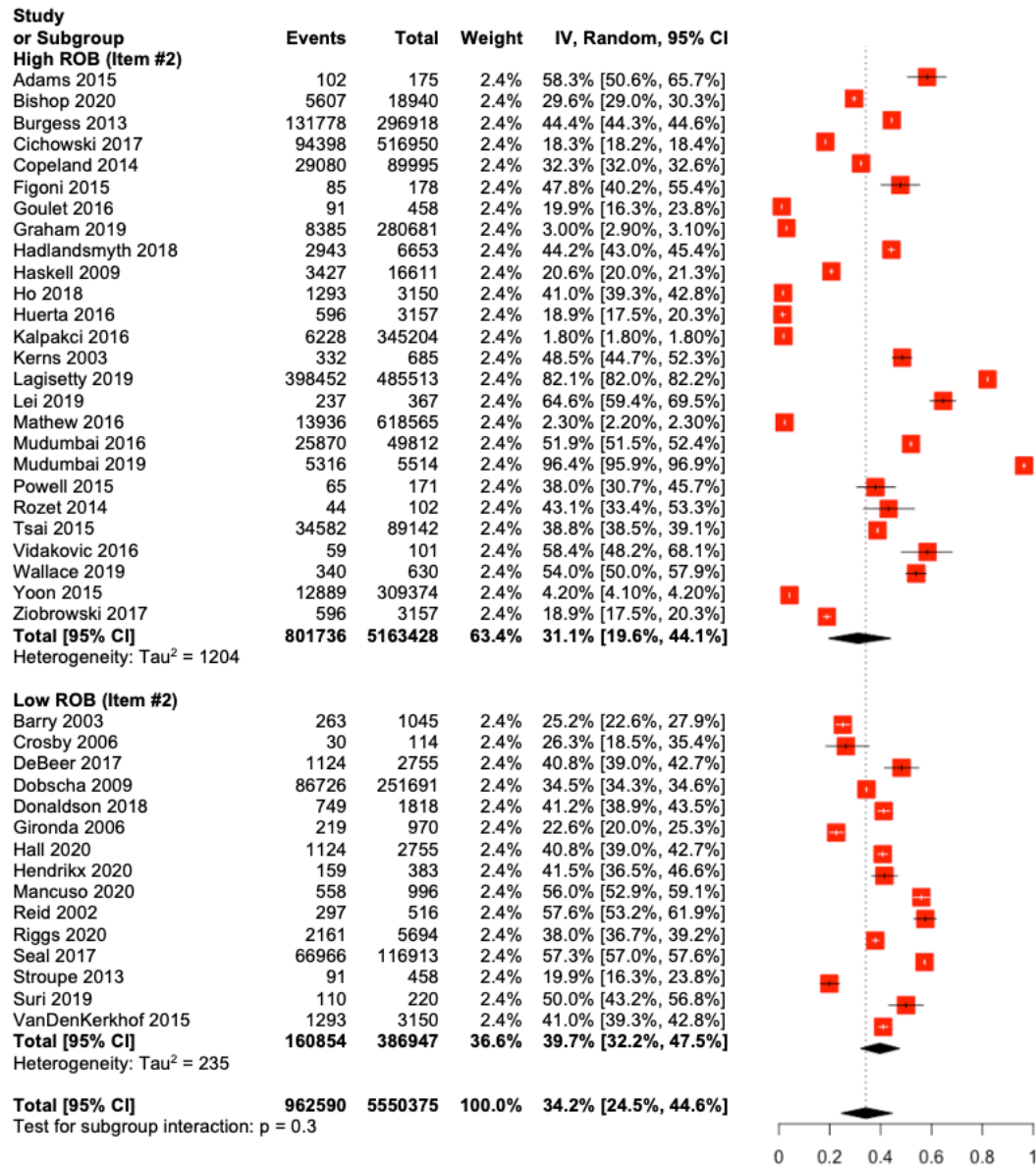


**Supplementary Material 10.** Subgroup analysis of chronic non-cancer pain prevalence with respect to threshold. CI = confidence interval; IV = inverse variance.

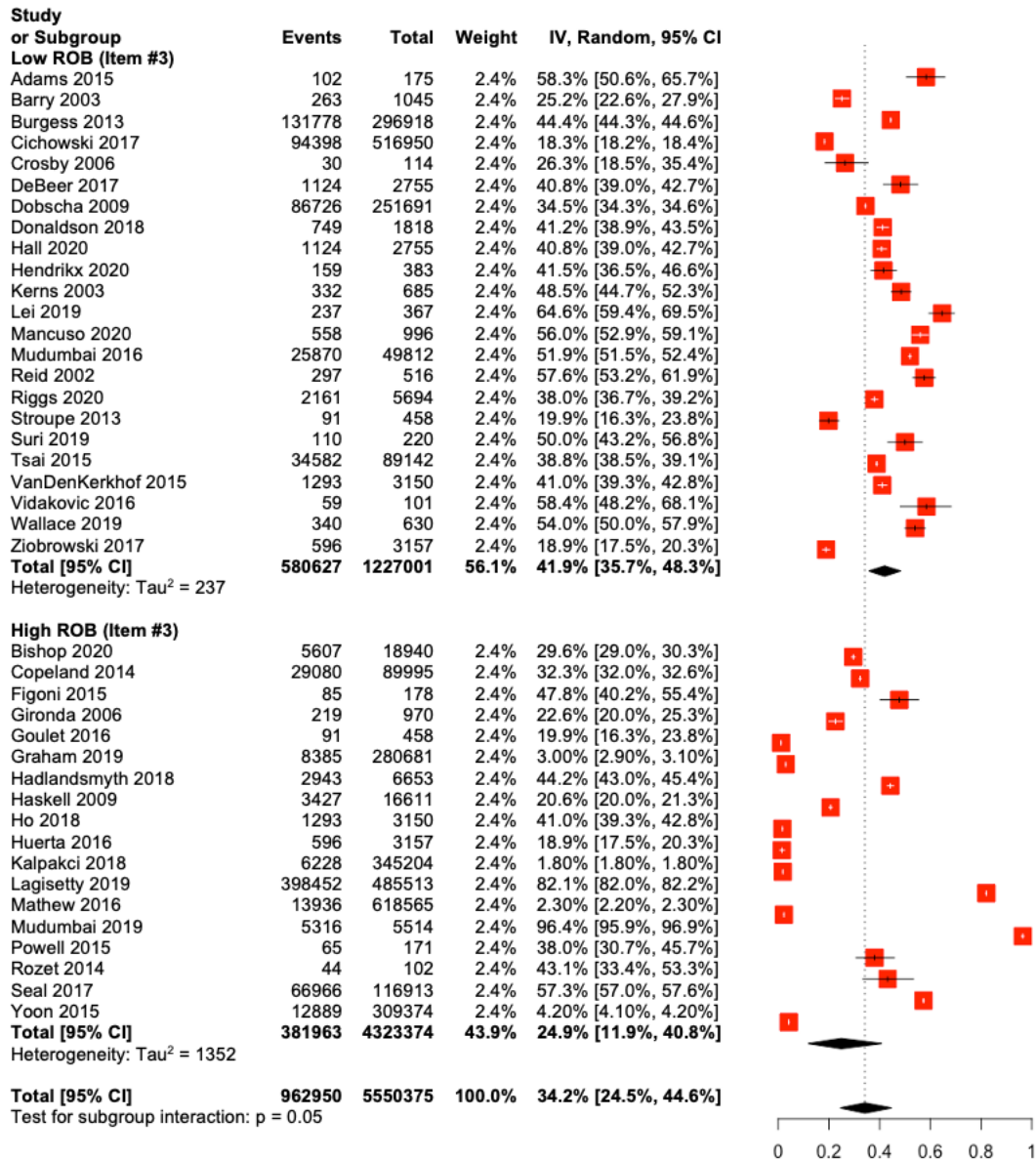


**Supplementary Material 11.** Subgroup analysis of chronic non-cancer pain prevalence with respect to ROB item #1. CI = confidence interval; IV = inverse variance.

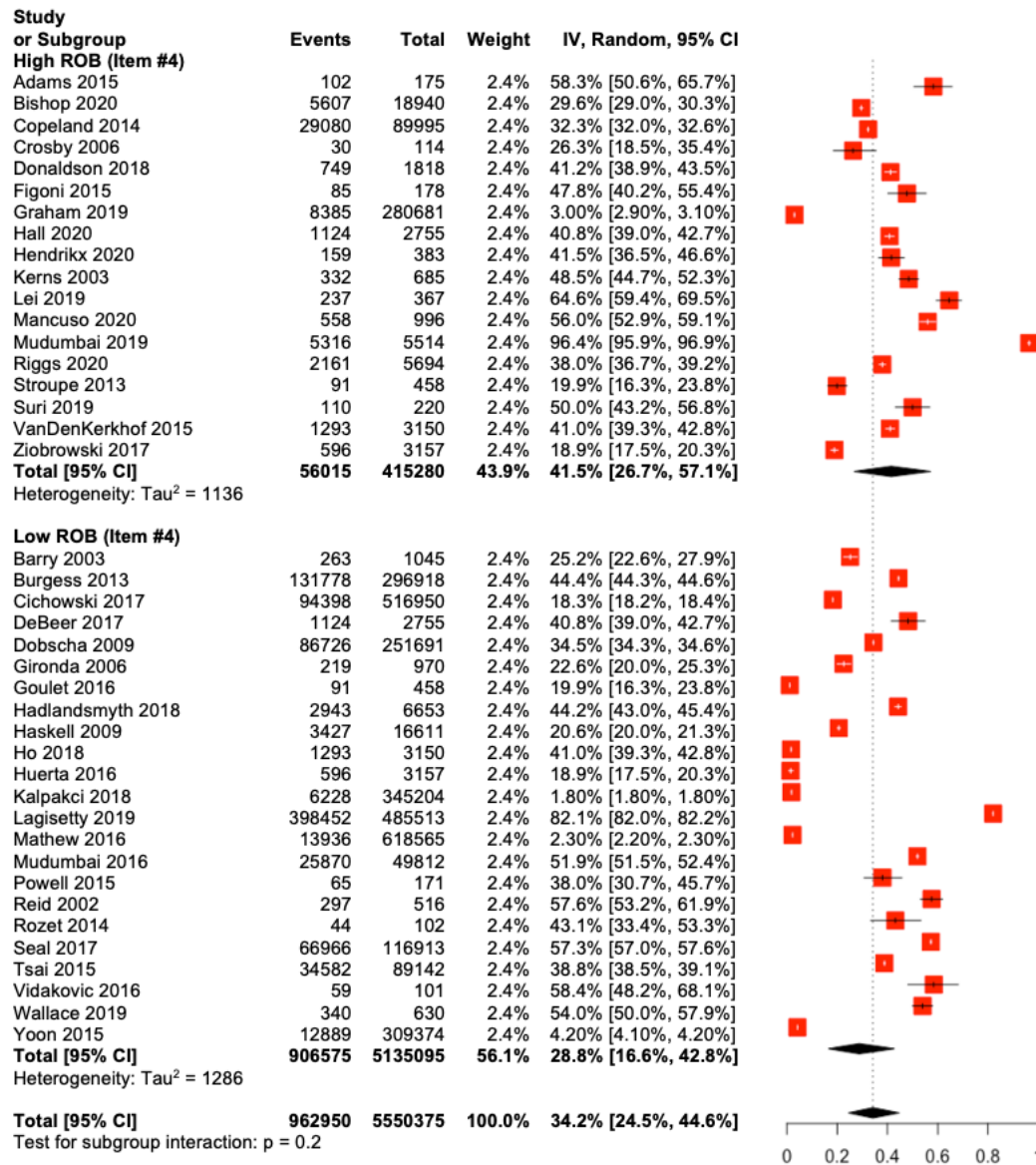




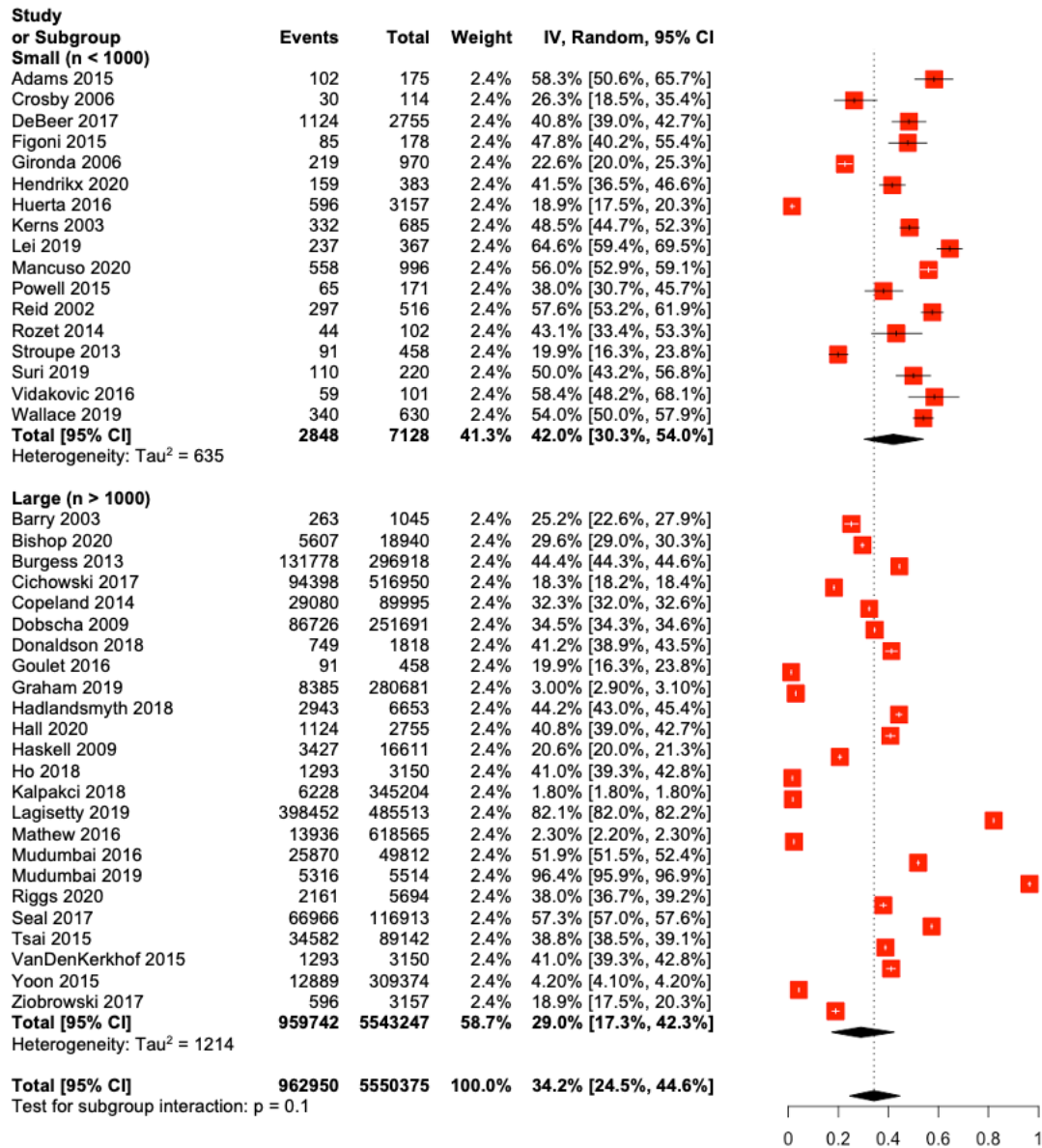
**Supplementary Material 12.** Subgroup analysis of chronic non-cancer pain prevalence with respect to ROB item #2. CI = confidence interval; IV = inverse variance.



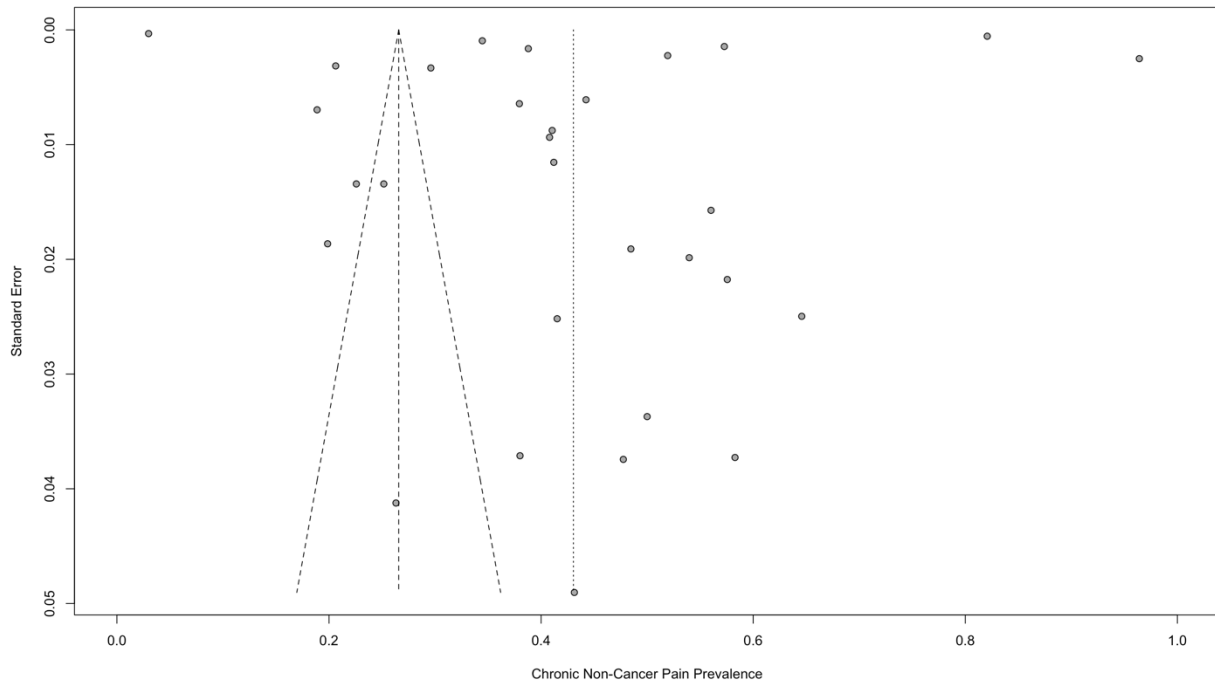
**Supplementary Material 13.** Subgroup analysis of chronic non-cancer pain prevalence with respect to ROB item #3. CI = confidence interval; IV = inverse variance.



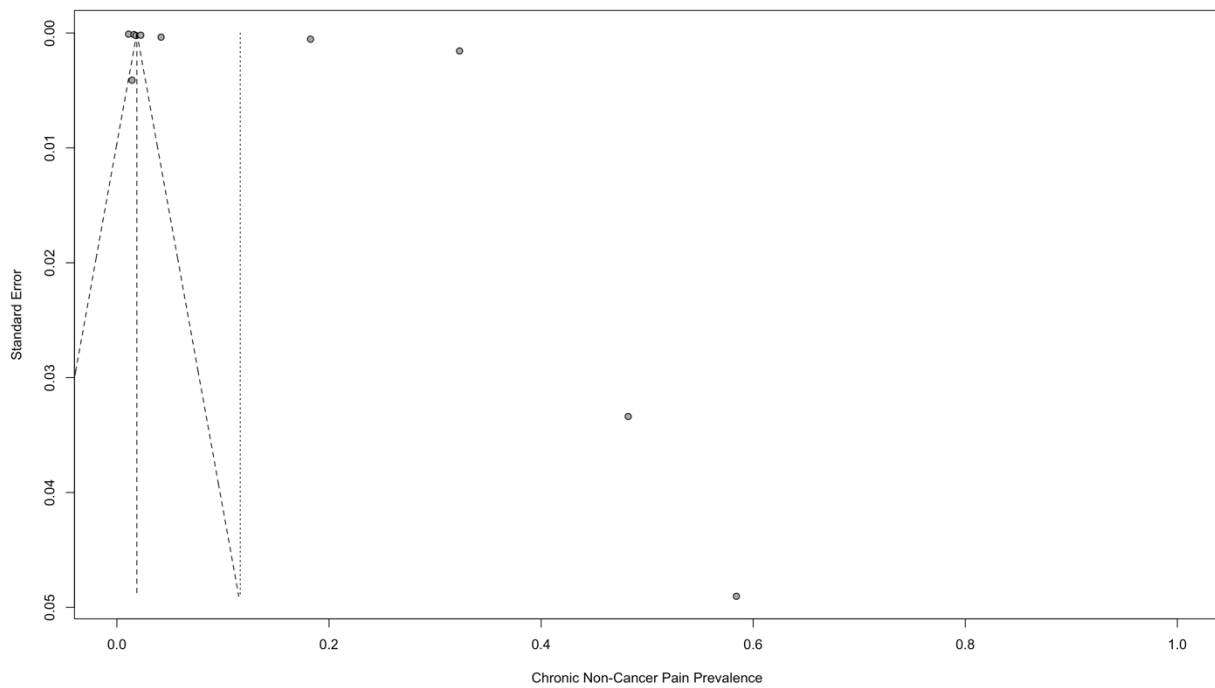
**Supplementary Material 14.** Subgroup analysis of chronic non-cancer pain prevalence with respect to ROB item #4. CI = confidence interval; IV = inverse variance.



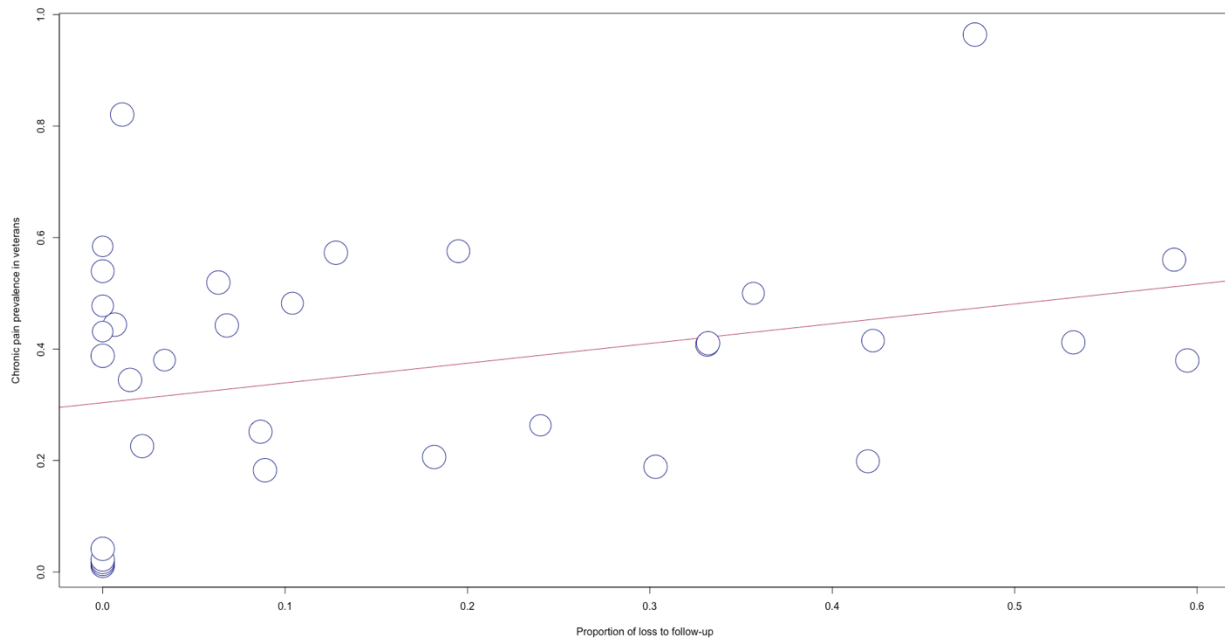
**Supplementary Material 15.** Subgroup analysis of small studies (n < 1000) vs large studies (n > 1000) for the outcome of chronic non-cancer pain prevalence. CI = confidence interval; IV = inverse variance.



**Supplementary Material 16.** Funnel plot of studies in the Generic CNCP prevalence subgroup. Begg's test:  $p = 0.008$ .



**Supplementary Material 17.** Funnel plot of studies in the Specific CNCP prevalence subgroup. Begg's test:  $p = 0.1$ .



**Supplementary Material 18.** Meta-regression of chronic non-cancer pain prevalence using the predictor of proportion lost to follow-up;  $p < 0.0001$ .

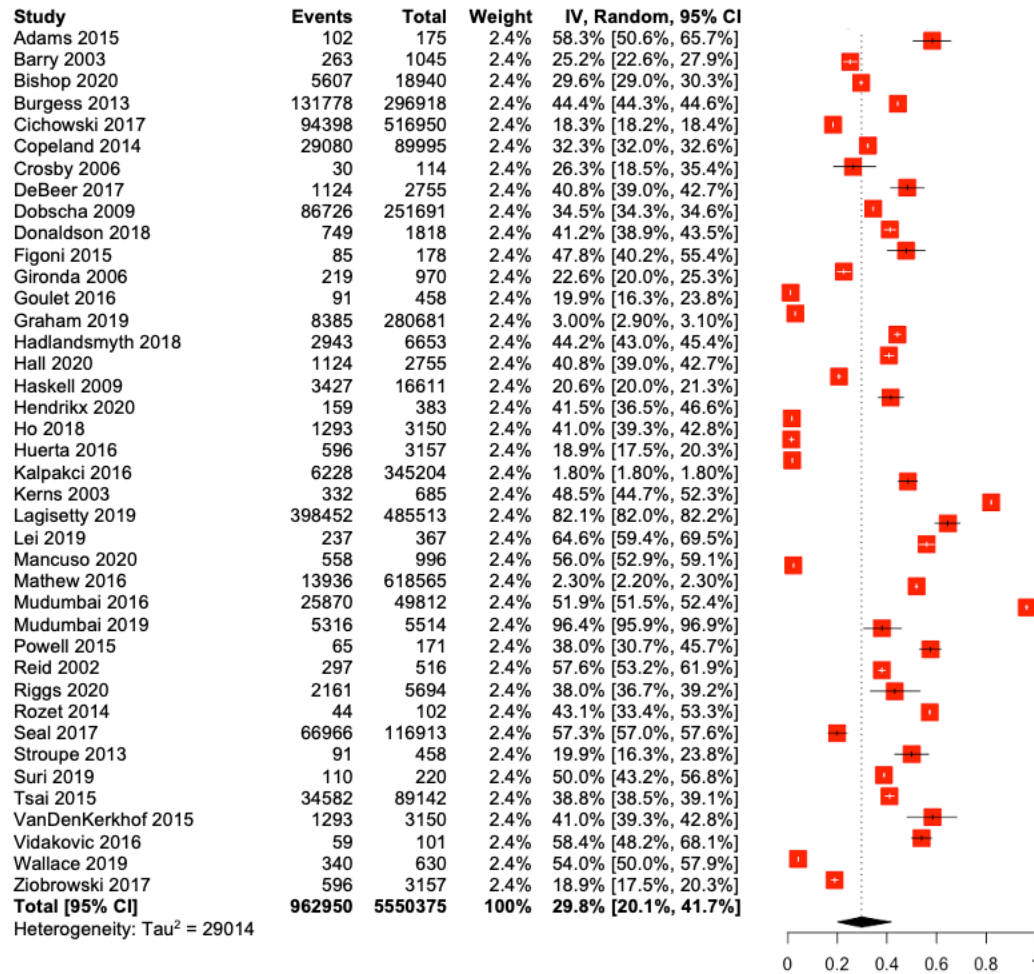
**Supplementary Material 19.** Summative data of all meta-regression models. \*

Model No.	CNC P Prevalence		Factor(s) ‡	p value
	No. of studies†	Total sample size (N)		
1	35	5,159,532	Proportion lost to follow-up	< 0.0001
2	35	5,159,532	Proportion lost to follow-up	0.05
			Prevalence measure type	< 0.0001
			ROB Item #3	0.4

\* ROB = Risk of bias; CNC P = Chronic non-cancer pain; No. = Number.

† Calculation of proportion lost to follow-up included military veterans that were excluded for the reason of missing data. Six studies stated that there *is* missing data that was excluded but failed to report the proportion that was missing. These six studies are excluded, and hence there are 35 studies in the meta-regression.

‡ Effect modifiers that had a statistically significant test of interaction were then placed together into a meta-regression model alongside the factor of proportion lost to follow-up.



**Supplementary Material 20.** Sensitivity analysis of chronic non-cancer pain prevalence based on the use of a logit transformation. CI = confidence interval; IV = inverse variance.

**Supplementary Material 21.** Summative data of all meta-analyses.\*

Analysis	Subgroup	No. of studies	No. with CNCP	Total	Effect Size	Point estimate	95% CI	Heterogeneity	p value for test of interaction
Overall analysis	NA	41	962,590	5,550,375	Prevalence	34.2	(24.5, 44.6)	$\tau^2 = 1240$	NA
Study size	Large studies	24	959,752	5,543,247	Prevalence	29.0	(17.3, 42.3)	$\tau^2 = 1214$	0.15
Study size	Small studies	17	2,848	7,128	Prevalence	42.0	(30.3, 54.1)	$\tau^2 = 635$	
Sex difference	Male	6	124,890	662,208 males	Prevalence	26.2	(6.50, 53.1)	$\tau^2 = 1213$	0.76
Sex difference	Female	6	12,776	48,175 females	Prevalence	31.1	(13.9, 51.6)	$\tau^2 = 682$	
Pain-reporting	Patient-reported	16	97,647	287,330	Prevalence	37.8	(33.3, 42.4)	$\tau^2 = 88$	0.41
Pain-reporting	Clinician-assessed	25	864,943	5,263,045	Prevalence	31.9	(19.8, 45.4)	$\tau^2 = 1245$	
Pain threshold	High	5	8,095	12,909	Prevalence	56.1	(18.2, 90.3)	$\tau^2 = 2131$	0.24
Pain threshold	Low	36	954,495	5,537,466	Prevalence	31.3	(21.3, 42.3)	$\tau^2 = 1204$	
ROB Item 1 – Population representativeness	High	29	867,632	5,267,697	Prevalence	35.2	(23.5, 47.9)	$\tau^2 = 1246$	0.62
ROB Item 1 – Population representativeness	Low	12	94,958	282,678	Prevalence	31.8	(26.6, 37.3)	$\tau^2 = 99$	
ROB Item 2 – Outcome measure validity	Low	15	160,854	5,163,428	Prevalence	39.7	(32.2, 47.5)	$\tau^2 = 235$	0.26
ROB Item 2 – Outcome measure validity	High	26	801,736	386,947	Prevalence	31.2	(19.6, 44.1)	$\tau^2 = 1204$	
ROB Item 3 – Under-reporting risk	High	18	580,627	4,323,374	Prevalence	24.9	(11.9, 40.8)	$\tau^2 = 1352$	0.05
ROB Item 3 – Under-reporting risk	Low	23	381,963	1,227,001	Prevalence	41.9	(35.7, 48.3)	$\tau^2 = 237$	



ROB Item 4 – Incomplete data	Low	23	906,575	5,135,095	Prevalence	28.8	(16.6, 42.8)	$\tau^2 = 1283$	0.22
ROB Item 4 – Incomplete data	High	18	56,015	415,280	Prevalence	41.5	(26.7, 57.1)	$\tau^2 = 1136$	
Type of prevalence measure	Generic	31	778,907	1,641,972	Prevalence	42.8	(30.5, 55.5)	$\tau^2 = 1304$	< 0.0001
Type of prevalence measure	Specific	10	183,683	3,908,403	Prevalence	11.4	(6.42, 17.5)	$\tau^2 = 196$	
Sensitivity analysis using logit transformation	NA	41	962,950	5,550,375	Prevalence	29.8	(20.1, 41.7)	$\tau^2 = 29,014$	NA

\* The grey table rows indicate the results of the overall effect estimate; CNCP = chronic non-cancer pain; NA = not applicable; No. = number; ROB = risk of bias.

## **CHAPTER 3 - Research Priorities among Canadian Military Veterans living with Chronic Pain**

### **3.2. ABSTRACT**

**Background:** Chronic pain is a pervasive and debilitating condition that disproportionately affects military veterans. We recently completed a qualitative study of Canadian veterans living with chronic pain to identify their research priorities; however, the generalizability of our findings was uncertain.

**Methods:** From January to March 2021, we emailed a 45-item cross-sectional survey to a list of Canadian veterans that asked about the relative importance of 20 research priorities regarding chronic pain. We explored for statistical significance between male and female responses for any item in which the proportion of endorsement showed a  $\geq 10\%$  difference.

**Results:** 313 of 699 Canadian military veterans living with chronic pain completed  $\geq 50\%$  of the survey (45% response rate). Respondents were predominantly male (77%) with a median age of 52 (interquartile range [IQR] 44-58). All 20 research priorities listed in the survey were endorsed as very important by  $\geq 52\%$  of respondents, and three received endorsement by  $\geq 85\%$ : (I) optimizing chronic pain management after release from the military; and (II) identifying and (III) treating mental illness among veterans living with chronic pain. Women were more likely than men to endorse research on post-surgical care for chronic pain prevention or research on holistic care for chronic pain. Men were more likely than women to endorse research on physical activity or exercise for chronic pain. Individuals with higher gross income ( $\geq \$80,000$ ) were less likely to endorse research into physiotherapy for chronic pain, or chiropractic for chronic pain compared to those with lower gross income. Individuals with greater age are less likely to endorse research on medical cannabis for chronic pain.

**Conclusions:** The most salient research priorities among our respondents were optimizing chronic pain management during service and after discharge from the military, including co-morbid mental illness. Differences in gender, gross income, and age are implicated in the endorsement of therapy-related priorities, which include surgery, physical activity or exercise, chiropractic, and medical cannabis. Our findings provide insight into the research priorities of Canadian military veterans living with chronic pain. These findings should be considered by granting agencies when formulating calls for proposals, and by researchers who wish to undertake research that will address the needs of military veterans living with chronic pain.

### **3.3. INTRODUCTION**

Pain that persists for 3 months or more is defined as chronic [1]. Over 6 million Canadians suffer from chronic pain and its associated consequences, [2] including decreased quality of life and increased use of healthcare resources [3]. In 2019, chronic pain-related costs (direct and indirect) in Canada were estimated to range from \$38 to \$40 billion [5]. Chronic pain disproportionality affects veterans, and observational studies have found that 25-72% of ex-military personnel report chronic pain, [6] which is associated with disability, financial strain, and difficulties transitioning to civilian life [7].

In recognition of the need to optimize management of chronic pain among veterans, the Chronic Pain Centre of Excellence for Canadian Veterans was launched in April 2020. To ensure that research efforts by the centre are relevant to veterans, a qualitative study was completed that drew upon interviews with Canadian veterans living with chronic pain [8]. This study found that veterans supported research into prevention of chronic pain, including identification of barriers to care while in the military (e.g., stigma) and after transition to civilian life. Veterans also

identified the need to explore the effect of treatment options on more than just pain relief (e.g., function, emotional health, financial well-being), and the importance of comparative effectiveness research for available management strategies [8]. Overall, while the qualitative study did suggest several research priorities the generalizability of findings was uncertain.

We conducted a cross-sectional survey of Canadian veterans living with chronic pain to establish the generalizability of research priorities identified through this qualitative study, and to explore whether research priorities differ between male and female veterans. Understanding the research priorities of military veterans living with chronic pain will assist researchers and funders in prioritizing topics of greatest importance to veterans.

### **3.4. METHODS**

The reporting of this study is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (**Additional file 1**) [9]. We registered our study protocol on the Open Science Framework (<https://osf.io/pgukx>).

#### **3.4.1. Study design**

With the assistance of veterans, epidemiologists, and the results of a qualitative study of research priorities among veterans living with chronic pain, we developed a 45-item English and French-language survey using LimeSurvey (LimeSurvey GmbH, Hamburg, Germany). The survey was designed to capture demographic information and the importance of 20 research topics pertaining to chronic pain. The survey framed response options with either checkboxes or a 5-point Likert scale (very important, somewhat important, unsure, somewhat unimportant, and very unimportant), as closed-ended questions result in fewer incomplete questionnaires than open-

ended formats [10]. We also included an option for veterans to provide written comments regarding any other thoughts they may have on research priorities.

We pretested the final questionnaire with 7 Canadian veterans living with chronic pain, who commented on its clarity and comprehensiveness and on the time required to complete it (10-15 minutes). No further modifications were suggested by pretest participants. (**Additional file 2**). As the study was for a quality improvement initiative without an initial intent to publish, the Hamilton Integrated Research Ethics Board (HiREB) approved our survey for dissemination without ethics review [11].

### **3.4.2. Survey administration**

From January 2021 to March 2021, we sent email invitations for our survey to 729 Canadian veterans that had signed up to support chronic pain research with the Chronic Pain Centre of Excellence for Canadian Veterans. Interested recipients were eligible to complete the survey, in either English or French, after they confirmed both their veteran status and living with chronic pain. In addition to completing the survey online, we provided the option to have a paper-based version mailed along with a return envelope with pre-paid postage, or to fax the survey (RingCentral Inc, Belmont, California, U.S.) with a toll-free return number. At 2 and 4 weeks from the start date of survey distribution, invitation emails were re-sent to all non-responders.

### **3.4.3. Data analysis**

All survey responses were entered into a de-identified Microsoft Excel database, with a unique identifier number assigned to each participant. As participants were permitted to skip questions, missing values were present and only data that was reported contributed to analyses. If

participants completed <50% of survey items, their questionnaire was removed from all analyses. Categorical variables were presented as counts and percentages. Continuous variables were presented as mean and standard deviation when normally distributed, and median and interquartile range (IQR) when not. The Shapiro-Wilk test was used to determine the normality of the distribution for continuous variables. For purposes of presentation, we collapsed responses to individual research priorities into important (“Very important” and “Somewhat important”), “Unsure”, and unimportant (“Somewhat unimportant” and “Very unimportant”), as well as a separate section for “Very important” and “Important or less” (i.e., “Somewhat important”, “Unsure”, “Somewhat unimportant” and “Very unimportant”).

To reduce the risk of spurious associations due to multiple testing, an exploratory analysis was conducted in which we identified any individual research priority that was endorsed as important or less (i.e., “Important”, “Unsure”, “Unimportant” or “Very Unimportant”) by  $\geq 20\%$  of respondents, created a dichotomous variable based on this dichotomization (i.e., very important; important or less), and thereafter conducted univariable logistic regression analyses for the following predictors: age, gender, final military rank, gross income level, and years since discharge from the military. Subsequently, a multivariable logistic regression was conducted for each of these identified priorities, which was always adjusted for age and gender, and included any of the other three variables if they were statistically significant in the univariable logistic regression analysis for a given research priority. For the purposes of these analyses, gross income level was dichotomized based on the median gross income level category, in which all individuals at the median gross income level as well as below it were in one category, while all the individuals with a gross income level that is higher than the median in the other category. Final military rank was dichotomized based on commission status: commissioned members

(Officer, Chief warrant officer, and Petty officer) and non-commissioned members (Recruit, Junior non-commissioned member, and Senior non-commissioned member). A p-value of 0.05 was used as the threshold for statistical significance. All analyses were performed using SPSS Statistics 26.0 (IBM Corp., New York, NY).

#### **3.4.4. Thematic analysis**

A thematic analysis was conducted on the open-ended response question (Q45). Two independent reviewers evaluated the written responses to determine themes and subthemes with a coding strategy that was developed through discussion. An *a priori* decision was made that a subtheme would only be presented if it was endorsed by  $\geq 2$  survey respondents. Illustrative quotes were selected for themes and subthemes, guided by a consensus on informativeness and representativeness among the two reviewers.

### **3.5. RESULTS**

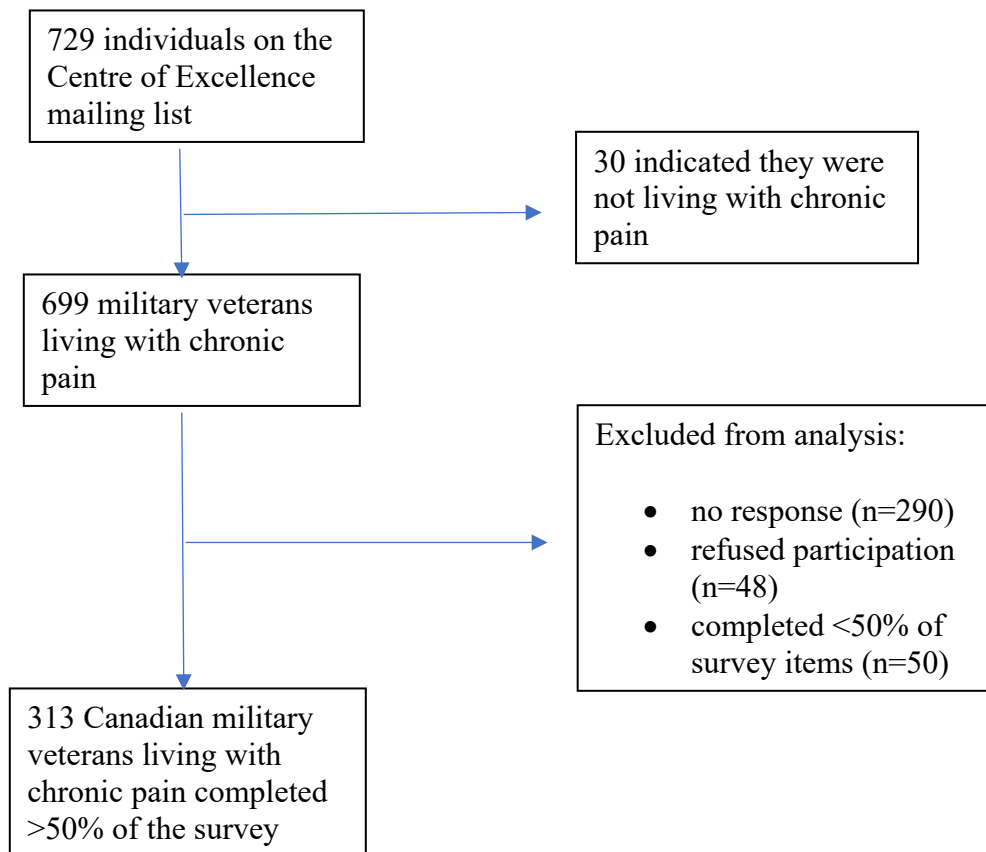
#### **3.5.1. Characteristics of respondents**

Among 729 Canadian military veterans who were invited to complete our survey, 30 were not experiencing chronic pain. Of the remaining 701, we received surveys with  $>50\%$  of items completed from 313 respondents (45% response rate) (**Figure 1**). Respondents were predominantly male (77%) with a median age of 52 (IQR 46-59), and most (66%) were married. A third of all veterans were receiving disability benefits (32%) and a third were retired (34%) (**Table 1**). Most respondents identified as White or European (87%), and the most reported formal education level completed was high school (40%). Similar proportions of veterans resided in urban (33%), suburban (39%), or rural (28%) areas.

Most veterans had served in the army (67%) as an active force member (87%) and had an operational or combat-related focus in their military vocation (58%). The top three final military ranks by frequency were junior non-commissioned member (39%), senior non-commissioned member (24%), and officer (17%). Respondents served in the military for a median of 20 years (IQR 12-28) and had been out of the military for a median of 8 years (IQR 3-15). (**Table 2**).

Veterans reported having lived with chronic pain for a median of 15 years (IQR 9-22), and only 6% were very satisfied with their current chronic pain care (**Table 3**).





**Figure 1.** Survey administration results.

**Table 1.** Demographic characteristics of survey respondents

Variable*	Frequency, n (%) or Median (IQR)		
	Overall †	Male	Female
Age (n)	(n=312)	(n=239)	(n=70)
Median (IQR)	52 (44-58)	53 (46-59)	51 (42-58)
<b><i>Current province or territory of residence</i></b>	<b>(n=311)</b>	<b>(n=239)</b>	<b>(n=70)</b>
Ontario	94 (30%)	70 (29%)	24 (34%)
Manitoba	10 (3%)	8 (3%)	2 (3%)
Quebec	22 (7%)	13 (6%)	8 (11%)
Nova Scotia	48 (15%)	35 (15%)	13 (19%)
New Brunswick	18 (6%)	14 (6%)	3 (4%)
Newfoundland and Labrador	18 (6%)	16 (7%)	2 (3%)
Alberta	44 (14%)	36 (15%)	8 (11%)
British Columbia	46 (15%)	37 (16%)	9 (13%)
Other	11 (4%)	10 (4%)	1 (2%)
<b><i>Current relationship status</i></b>	<b>(n=311)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Single/Never Married	22 (7%)	15 (6%)	7 (10%)
Married	207 (66%)	171 (71%)	34 (48%)
Common law	36 (12%)	30 (13%)	6 (9%)
Separated	18 (6%)	10 (4%)	8 (11%)
Divorced	26 (8%)	15 (6%)	11 (16%)
Widowed	4 (1%)	0 (0%)	4 (6%)
<b><i>Living situation with other individual(s) ‡</i></b>	<b>(n=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Spouse/Partner	247 (79%)	205 (85%)	40 (57%)
Children	110 (35%)	83 (34%)	26 (37%)
Parent(s)	9 (3%)	6 (3%)	3 (4%)
No one, I live alone	45 (14%)	27 (11%)	18 (26%)
Other	12 (4%)	10 (4%)	2 (3%)
<b><i>Current region of residence</i></b>	<b>(n=312)</b>	<b>(n=241)</b>	<b>(n=69)</b>
Urban (in the city)	102 (33%)	77 (32%)	25 (36%)
Suburban (mixed-use or residential area, existing either as part of a city area or as a separate residential community within commuting distance of a city)	121 (39%)	96 (40%)	23 (33%)
Rural (in the country)	89 (28%)	68 (28%)	21 (31%)
<b><i>Current housing situation</i></b>	<b>(n=312)</b>	<b>(n=240)</b>	<b>(n=70)</b>
Own property	245 (78%)	189 (78%)	56 (79%)
Rent property	62 (20%)	47 (20%)	13 (19%)
Other	5 (2%)	4 (2%)	1 (2%)
<b><i>Current employment status</i></b>	<b>(n=312)</b>	<b>(n=241)</b>	<b>(n=69)</b>
Employed, full-time	68 (22%)	57 (24%)	11 (16%)
Employed, part-time	15 (5%)	14 (6%)	1 (2%)
Unemployed	9 (3%)	9 (4%)	1 (2%)
Unemployed, and receiving disability benefits	99 (32%)	63 (26%)	33 (47%)
Retired	107 (34%)	87 (36%)	20 (29%)
Other	14 (4%)	11 (4%)	3 (4%)
<b><i>Current gross income level</i></b>	<b>(n=309)</b>	<b>(n=238)</b>	<b>(n=69)</b>
Below \$25,000	6 (2%)	6 (3%)	0 (0%)
\$25,000 to \$49,000	49 (16%)	37 (15%)	12 (17%)
\$50,000 to \$59,000	57 (18%)	42 (18%)	13 (19%)
\$60,000 to \$79,000	79 (26%)	60 (25%)	19 (28%)
\$80,000 to \$99,000	56 (18%)	42 (18%)	14 (20%)

\$100,000 to \$150,000	49 (16%)	40 (17%)	9 (13%)
More than \$150,000	13 (4%)	11 (4%)	2 (3%)
People supported by gross income (n)	(n=311)	(n=240)	(n=69)
Median (IQR)	2 (2-3)	2 (2-3)	2 (1-3)
<b>Race/ethnicity</b>	<b>(n=311)</b>	<b>(n=239)</b>	<b>(n=70)</b>
Asian – Southeast (e.g., Malaysian, Filipino, Vietnamese, Cambodian)	2 (1%)	0 (0%)	2 (3%)
Black – Caribbean Region (e.g., Barbadian, Jamaican)	3 (1%)	1 (1%)	2 (3%)
Indigenous (e.g., Inuit, First Nations, Non-Status Indian, Metis, Indigenous person from outside Canada)	11 (3%)	8 (3%)	2 (3%)
White/European (e.g., English, Italian, Portuguese, Russian)	267 (85%)	209 (88%)	57 (81%)
Prefer not to answer	14 (5%)	13 (5%)	1 (1%)
French Canadian	5 (2%)	3 (1%)	2 (3%)
Other	9 (3%)	5 (2%)	4 (6%)
<b>Highest formal education level completed</b>	<b>(n=310)</b>	<b>(n=238)</b>	<b>(n=70)</b>
University Degree	68 (22%)	44 (18%)	24 (34%)
College Degree	93 (30%)	72 (30%)	21 (30%)
College Diploma	7 (2%)	2 (1%)	5 (7%)
Trades	8 (3%)	8 (3%)	0 (0%)
High School	126 (40%)	106 (45%)	19 (27%)
Other	8 (3%)	6 (3%)	1 (2%)

\* “Other” for “Current province or territory of residence” includes Prince Edward Island, Saskatchewan, USA and Unspecified; “Other” for “Living situation with other individual(s)” includes Caregiver, Grandchildren, Roommate(s) and Friend(s); “Other” for Current housing situation includes Partner owns property, Family member owns property, Military housing, and RV housing; “Other” for Current employment status includes Retired and receiving disability benefits, Employed, casual and receiving disability benefits, Self-employed, unspecified-time, Self-employed, and receiving disability benefits, Retired but employed, part-time, Retired but employed, unspecified-time, Unspecified, Employed, unspecified time, and Employed, on-call; “Other” for Race/ethnicity includes Asian – East (e.g. Chinese, Japanese, Korean), Asian – South (e.g. Indian, Pakistani, Sri Lankan, Indo-Caribbean/West Indian), Asian – West (e.g., Afghani, Israeli, Saudi Arabian, Iranian, Turkish), Australasian – (e.g. Australian, New Zealander, Papuan, Melanesian), Black – Africa (e.g. Ghanaian, Kenyan, Somali), Black – North America, Hispanic, Latin American (e.g. Argentinean, Chilean, Salvadoran), Do not know, Black and Indigenous, White/European and Indian – Unspecified, and White/European and Asian – Unspecified; “Other” for Highest formal education level completed includes College Certificate, Post-Secondary Diploma, Military College Courses, Certificate – Unspecified institution, and Unspecified; IQR = interquartile range.

† 1 individual reported to be “Another Gender Identity”, and another individual selected “Prefer not to answer” for the question on Gender.

‡ Categories are *not* mutually exclusive.

**Table 2.** Military characteristics of survey respondents.\*

Variable*	Frequency, n (%) or Median (IQR)		
	Overall †	Male	Female
<b>Country of military presence ‡</b>	<b>(N=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Canada	310 (99%)	239 (99%)	69 (99%)
United States of America	19 (6%)	19 (8%)	0 (0%)
Bosnia	8 (3%)	3 (1%)	5 (7%)
Afghanistan	11 (4%)	9 (4%)	2 (3%)
Germany	12 (4%)	10 (4%)	2 (3%)
Other	39 (12%)	33 (14%)	6 (9%)
<b>Military branch of service ‡</b>	<b>(N=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Air Force	131 (42%)	99 (41%)	32 (46%)
Army	209 (67%)	163 (68%)	44 (63%)
Navy	83 (27%)	66 (27%)	17 (24%)
Special Forces	16 (5%)	14 (6%)	2 (2.9%)
Unspecified	5 (2%)	1 (1%)	4 (6%)
Other	4 (1%)	3 (1%)	1 (1%)
<b>Final military rank</b>	<b>(N=312)</b>	<b>(n=240)</b>	<b>(n=69)</b>
Officer	52 (17%)	37 (15%)	14 (20%)
Warrant officer	47 (15%)	42 (18%)	5 (7%)
Senior non-commissioned member	75 (24%)	65 (27%)	10 (15%)
Junior non-commissioned member	122 (39%)	87 (36%)	34 (49%)
Recruit	10 (3%)	5 (2%)	5 (7%)
Petty officer	6 (2%)	5 (2%)	1 (2%)
<b>Military component</b>	<b>(N=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Regular (or Active Force)	272 (87%)	220 (91%)	50 (72%)
Reserve Force – Primary	31 (10%)	14 (6%)	17 (24%)
Other	10 (3%)	7 (3%)	3 (4%)
<b>Primary focus of occupational specialty in military</b>	<b>(N=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Operational or Combat-related	180 (58%)	158 (66%)	20 (29%)
Operational support (i.e., Non-operational or non-combat related positions that assisted operational or combat-related forces to deliver their mission).	100 (32%)	67 (28%)	33 (47%)
Institutional support (i.e., Non-operational or non-combat related positions that were not involved in assisting operational or combat-related forces directly; e.g., base/wing positions, support for educational institutions)	26 (8%)	12 (5%)	14 (20%)
Other	7 (2%)	4 (1%)	3 (4%)
<b>Years of service in military (n)</b>	<b>(n=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Median (IQR)	20 (12-28)	21 (13-30)	16 (8-24)
<b>Years since discharge from military (n)</b>	<b>(n=312)</b>	<b>(n=240)</b>	<b>(n=70)</b>
Median (IQR)	8 (3-15)	8 (3-15)	7 (3-17)

\* “Other” for *Country of military presence* includes UK, Australia, Italy, Cyprus, Belgium, Haiti, Croatia, Israel, Egypt, UAE, Macedonia, Syria, Bahrain, Saudi Arabia, Nairobi, Uganda, Turkey, Kuwait, Scotland, Mexico, Democratic Republic of the Congo, Africa, Persian Gulf, Southeast Asia and Eastern Europe; “Other” for “Military branch of service” includes Logistics, Medical Services, and Marines; “Other” for “Military component” included Reserve Force – Cadet Organizations Administration and Training Service and Regular (or Active) Force and Reserves – Unspecified and Regular Force and Reserve – Primary; “Other” for “Primary focus of occupational specialty in military” included All of the above, Operational and Unspecified support, Operational support and Institutional support and Operational and Operational support; IQR = interquartile range.

† “n=313” for Overall results from 1 individual selecting “Prefer not to answer” and another selecting “Another Gender Identity” for the “Gender” question.

‡ Categories are *not* mutually exclusive.

**Table 3.** Chronic pain-related characteristics among respondents.\*

<b>Variables</b>	<b>Frequency, n (%) or Median (IQR)</b>		
	<i>Overall †</i>	<i>Male</i>	<i>Female</i>
<b>Number of years living with chronic pain (n)</b>	(n=311)	(n=239)	(n=70)
Median (IQR)	15 (9-22)	15 (10-22)	12 (8-21)
<b><i>Chronic pain as part of claim to Veteran Affairs Canada</i></b>	<b>(N=311)</b>	<b>(n=239)</b>	<b>(n=70)</b>
All of the time	156 (50%)	119 (50%)	35 (50%)
Most of the time	72 (23%)	53 (22%)	19 (27%)
Sometimes	39 (13%)	32 (13%)	7 (10%)
Rarely	15 (5%)	11 (4%)	4 (6%)
Never	24 (7%)	21 (9%)	3 (4%)
I have never filed a claim to Veterans Affairs Canada	6 (2%)	4 (2%)	2 (3%)
<b><i>Rating of satisfaction with current chronic pain care</i></b>	<b>(N=313)</b>	<b>(n=241)</b>	<b>(n=70)</b>
Very unsatisfied	71 (22%)	60 (25%)	10 (14%)
Somewhat unsatisfied	78 (25%)	58 (24%)	20 (29%)
Unsure	62 (20%)	45 (19%)	17 (24%)
Somewhat satisfied	84 (27%)	66 (27%)	17 (24%)
Very satisfied	18 (6%)	12 (5%)	6 (9%)

\* IQR = interquartile range; SD = standard deviation.

† Overall total includes one individual that stated “Another Gender Identity” for the question about sex.

### 3.5.2. Research priorities

All 20 research priorities listed in the survey were endorsed by  $\geq 75\%$  of respondents as important, and no more than 8% of veterans designated any priority as unimportant. Four research priorities received endorsement by  $\geq 95\%$  of military veterans: (i) optimizing chronic pain management after release from the military (97%); (ii) establishing the effectiveness of self-care (96%); and (iii) identifying (95%) and (iv) treating (95%) mental illness among veterans living with chronic pain.

Ten research priorities received endorsement by  $\geq 90\%$  of military veterans: (i) improving chronic pain care while in the military (93%); (ii) addressing barriers to chronic pain management in the military (92%); (iii) reducing the length of time for chronic pain claims to be adjudicated by Veterans Affairs Canada (94%); (iv) improving civilian doctors' knowledge on military life and impact of military service in relation to chronic pain (94%); (v) understanding risk factors during military service that are associated with chronic pain development (93%); (vi) optimizing post-surgical care to prevent chronic pain development (91%); (vii) establishing the effectiveness of physiotherapy (93%), (viii) massage therapy (91%) or (ix) physical activity/exercise (94%) for chronic pain; and (x) exploring the contribution of administrative barriers to chronic pain development and perpetuation (93%).

Two research priorities received the endorsement of  $\geq 85\%$  of military veterans: (i) improving acute pain care while in the military to avoid development of chronic pain (88%), and (ii) exploring the impact of treatment decision aids (89%), (**Table 4**).

**Table 4.** Responses to questions on the “Research Priorities” section of the 45-item survey.\*

<b>Research Priority identified from the Survey Question</b>	<b>n</b>	<b>Frequency stratified by Very Important n (%) †</b>		<b>Frequency n (%) ‡</b>				
		<b>Very Important</b>	<b>Important or less</b>	<b>Very Important</b>	<b>Somewhat Important</b>	<b>Unsure</b>	<b>Somewhat Unimportant</b>	<b>Very Unimportant</b>
Improving acute pain (<1 month in duration) care while in the military to reduce risk of developing chronic pain. (Q23)	313	230 (73%)	83 (27%)	230 (73.5%)	46 (14.7%)	26 (8.3%)	7 (2.2%)	4 (1.3%)
Improving chronic pain (≥3 months duration) care while in the military. (Q24)	313	253 (80%)	60 (20%)	253 (80.8%)	37 (11.8%)	14 (4.5%)	6 (1.9%)	3 (1.0%)
Addressing barriers to chronic pain management within the military (e.g., stigma, lack of knowledge, inadequate treatment options or access to care). (Q25)	312	258 (82%)	54 (28%)	258 (82.4%)	30 (9.6%)	17 (5.4%)	3 (1.0%)	4 (1.3%)
Improving health care for chronic pain management after release from the military (e.g., improving access to a civilian family doctor). (Q26)	313	285 (91%)	28 (9%)	285 (91.1%)	17 (5.4%)	4 (1.3%)	3 (1.0%)	4 (1.3%)
Reducing the length of time for chronic pain claims to be adjudicated by Veterans Affairs Canada. (Q27)	313	264 (84%)	49 (16%)	264 (84.3%)	31 (9.9%)	13 (4.2%)	2 (0.6%)	3 (1.0%)
Improving civilian doctors' knowledge of military life and the impact of military service as it relates to the development of chronic pain. (Q28)	312	257 (82%)	55 (18%)	257 (82.1%)	32 (10.2%)	14 (4.5%)	6 (1.9%)	3 (1.0%)
Understanding risk factors during military service that are associated with the development of chronic pain. (Q29)	309	245 (79%)	64 (21%)	245 (78.3%)	43 (13.7%)	11 (3.5%)	6 (1.9%)	4 (1.3%)
Optimizing post-surgical care to prevent the development of chronic pain. (Q30)	312	221 (71%)	91 (29%)	221 (70.6%)	62 (19.8%)	20 (6.4%)	5 (1.6%)	4 (1.3%)
Establishing the effectiveness of physiotherapy for chronic pain. (Q31)	312	221 (71%)	91 (29%)	221 (70.6%)	68 (21.7%)	11 (3.5%)	9 (2.9%)	3 (1.0%)
Establishing the effectiveness of massage therapy for chronic pain. (Q32)	313	229 (73%)	84 (27%)	229 (73.2%)	55 (17.6%)	22 (7.0%)	5 (1.6%)	2 (0.6%)
Establishing the effectiveness of physical activity/exercise for chronic pain. (Q33)	312	232 (74%)	80 (26%)	232 (74.1%)	61 (19.5%)	13 (4.2%)	3 (1.0%)	3 (1.0%)
Establishing the effectiveness of holistic care (e.g., addressing all relevant factors, not just pain, such as mental health, financial health and quality of life) for chronic pain. (Q34)	313	231 (74%)	82 (26%)	231 (73.8%)	53 (16.9%)	21 (6.7%)	5 (1.6%)	3 (1.0%)
Effectiveness of self-care (i.e., what patients can do for themselves) for chronic pain. (Q35)	312	241 (77%)	71 (23%)	241 (77.0%)	59 (18.8%)	6 (1.9%)	3 (1.0%)	3 (1.0%)
Exploring the contribution of administrative barriers (e.g., delay in VA claim approval) to the development and perpetuation of chronic pain. (Q36)	311	242 (78%)	69 (22%)	242 (77.3%)	48 (15.3%)	12 (3.8%)	5 (1.6%)	4 (1.3%)
Establishing the effectiveness of chiropractic care for chronic pain. (Q37)	313	172 (55%)	141 (45%)	172 (55.0%)	70 (22.4%)	49 (15.7%)	9 (2.9%)	13 (4.2%)
Establishing the effectiveness of medical cannabis for chronic pain. (Q38)	313	164 (52%)	149 (48%)	164 (52.4%)	72 (23.0%)	53 (16.9%)	14 (4.5%)	10 (3.2%)
Reducing the use of opioids for chronic pain. (Q39)	313	214 (68%)	99 (32%)	214 (68.4%)	42 (13.4%)	33 (10.5%)	10 (3.2%)	14 (4.5%)
Identifying mental illness among veterans living with chronic pain. (Q40)	313	270 (86%)	43 (14%)	270 (86.3%)	26 (8.3%)	14 (4.5%)	1 (0.3%)	2 (0.6%)
Treatment of mental illness among veterans living with chronic pain. (Q41)	313	276 (88%)	37 (12%)	276 (88.2%)	23 (7.3%)	11 (4.0%)	1 (0.3%)	2 (0.6%)
Effectiveness of providing treatment decision aids (evidence summaries conveying benefits and harms of different therapeutic options) to veterans living with chronic pain. (Q42)	312	217 (70%)	95 (30%)	217 (69.3%)	62 (19.8%)	28 (8.9%)	4 (1.3%)	1 (0.3%)

\* Q = Question; VA = Veterans Affairs; † = “Important or less” includes “Somewhat important”, “Unsure”, “Somewhat unimportant” and “Very unimportant”; ‡ = “Important” includes “Very important” and “Somewhat important”, while “Unimportant” includes “Somewhat unimportant” and “Very unimportant”.

### 3.5.3. Highest and lowest research priorities

There was no clear indication as to which research priority was most or least important to respondents. The leading three priorities were: (i) improving care for chronic pain after release from the military (17%); (ii) improving management of chronic pain while in the military (11%); and (iii) addressing barriers to chronic pain care in the military (9%). The three research areas of lowest priority were: (i) establishing the effectiveness of chiropractic care (13%); (ii) clarifying the role of medical cannabis for chronic pain (12%); and (iii) exploring strategies to reduce use of opioids among veterans living with chronic pain (11%) (**Additional file 3**).

### 3.5.4. Uni- and Multi-variable Logistic Regressions

After adjusting for age, women are 2.1 times more likely to endorse the optimization of post-surgical care to prevent the development of chronic pain compared to men (OR = 2.16, 95% CI 1.11 to 4.20,  $p = 0.02$ ). After adjusting for age and gender, individuals with a gross income level  $\geq \$80,000$  are 55% less likely to endorse research into establishing the effectiveness of physiotherapy for chronic pain, compared to those with a gross income level  $\leq \$79,000$  (OR = 0.45, 95% CI 0.27 to 0.75,  $p = 0.002$ ). After adjusting for age, women are 52% less likely than men to endorse research into establishing the effectiveness of physical activity or exercise for chronic pain (OR = 0.48, 95% CI 0.27 to 0.85,  $p = 0.01$ ). After adjusting for age, women are 2.2 times more likely to endorse research into establishing the effectiveness of holistic care for chronic pain (OR = 2.15, 95% CI 1.07 to 4.35,  $p = 0.03$ ). After adjusting for age and gender,



individuals with a gross income level  $\geq$ \$80,000 are 43% less likely to endorse research into establishing the effectiveness of chiropractic care for chronic pain compared to those with a gross income level  $\leq$ \$79,000 (OR = 0.57, 95% CI 0.36 to 0.91, p = 0.02). For every 10-year increase in age, odds of endorsing research exploring the effectiveness of medical cannabis for chronic pain decreases by 32%, after adjusting for gender (OR = 0.68, 95% CI 0.54 to 0.85, p = 0.001), (Table 5).

**Table 5.** Univariable and multi-variable regression analyses of research priorities with  $\geq$ 20% endorsement for important or less.

Research priority	Variable	Reference category	Univariable analysis			Multivariable analysis		
			OR	95% CI	P-value	OR	95% CI	P-value
Improving acute pain (<1 month in duration) care while in the military to reduce risk of developing chronic pain. (Q23)	Age	Every 10-year increase	1.00	0.77 to 1.30	0.9	1.00	0.78 to 1.28	0.8
	Gender	Male	1.80	0.92 to 3.49	0.08	1.83	0.94 to 3.56	0.08
	Gross income level	$\leq$ \$79,000	1.35	0.79 to 2.30	0.3	---	---	---
	Final rank while in the military	Non-Officer	0.64	0.37 to 1.11	0.1	---	---	---
	Years since release from the military	Every 10-year increase	0.81	0.65 to 1.00	0.06	---	---	---
Understanding risk factors during military service that are associated with the development of chronic pain. (Q29)	Age	Every 10-year increase	0.99	0.75 to 1.32	0.9	0.99	0.83 to 1.19	1.0
	Gender	Male	1.12	0.57 to 2.21	0.8	1.12	0.57 to 2.22	0.7
	Gross income level	$\leq$ \$79,000	0.56	0.32 to 0.99	0.05	---	---	---
	Final rank while in the military	Non-Officer	0.83	0.45 to 1.51	0.5	---	---	---

	Years since release from the military	Every 10-year increase	0.84	0.65 to 1.09	0.1	---	---	---
Optimizing post-surgical care to prevent the development of chronic pain. (Q30)	Age	Every 10-year increase	1.11	0.86 to 1.43	0.34	1.11	0.86 to 1.41	0.3
	Gender	Male	2.07	1.07 to 4.01	0.03	2.16	1.11 to 4.20	0.02
	Gross income level	≤ \$79,000	0.67	0.40 to 1.11	0.1	---	---	---
	Final rank while in the military	Non-Officer	0.85	0.50 to 1.44	0.5	---	---	---
	Years since release from the military	Every 10-year increase	1.00	0.78 to 1.28	0.8	---	---	---
Establishing the effectiveness of physiotherapy for chronic pain. (Q31)	Age	Every 10-year increase	1.00	0.77 to 1.30	0.9	0.99	0.79 to 1.23	0.9
	Gender	Male	0.79	0.45 to 1.40	0.4	0.74	0.41 to 1.33	0.3
	Gross income level	≤ \$79,000	0.46	0.28 to 0.77	0.003	0.45	0.27 to 0.75	0.002
	Final rank while in the military	Non-Officer	0.87	0.51 to 1.47	0.6	---	---	---
	Years since release from the military	Every 10-year increase	1.00	0.78 to 1.28	0.8	---	---	---
Establishing the effectiveness of massage therapy for chronic pain. (Q32)	Age	Every 10-year increase	0.73	0.57 to 0.93	0.01	0.74	0.54 to 1.00	0.06
	Gender	Male	0.97	0.53 to 1.77	0.9	0.88	0.48 to 1.63	0.7
	Gross income level	≤ \$79,000	0.68	0.41 to 1.14	0.1	---	---	---
	Final rank while in	Non-Officer	1.20	0.71 to 2.04	0.5	---	---	---

	the military							
	Years since release from the military	Every 10-year increase	0.78	0.63 to 0.97	0.03	0.94	0.72 to 1.23	0.7
Establishing the effectiveness of physical activity/exercise for chronic pain. (Q33)	Age	Every 10-year increase	1.11	0.88 to 1.38	0.5	1.11	0.87 to 1.40	0.6
	Gender	Male	0.48	0.27 to 0.85	0.01	0.48	0.27 to 0.85	0.01
	Gross income level	≤ \$79,000	0.72	0.43 to 1.22	0.2	---	---	---
	Final rank while in the military	Non-Officer	0.86	0.49 to 1.49	0.6	---	---	---
	Years since release from the military	Every 10-year increase	0.89	0.71 to 1.11	0.3	---	---	---
Establishing the effectiveness of holistic care (e.g., addressing all relevant factors, not just pain, such as mental health, financial health and quality of life) for chronic pain. (Q34)	Age	Every 10-year increase	0.93	0.72 to 1.21	0.5	0.95	0.74 to 1.22	0.7
	Gender	Male	2.20	1.09 to 4.43	0.03	2.15	1.07 to 4.35	0.03
	Gross income level	≤ \$79,000	0.80	0.47 to 1.34	0.4	---	---	---
	Final rank while in the military	Non-Officer	0.94	0.55 to 1.61	0.8	---	---	---
	Years since release from the military	Every 10-year increase	1.00	0.78 to 1.29	0.9	---	---	---
Effectiveness of self-care (i.e., what patients can do for themselves) for chronic pain. (Q35)	Age	Every 10-year increase	1.22	0.92 to 1.61	0.2	1.11	0.81 to 1.51	0.6
	Gender	Male	1.51	0.76 to 2.30	0.2	1.44	0.71 to 2.90	0.3
	Gross income level	≤ \$79,000	0.57	0.33 to 0.98	0.04	0.60	0.34 to 1.05	0.08

	Final rank while in the military	Non-Officer	0.63	0.35 to 1.15	0.1	---	---	---
	Years since release from the military	Every 10-year increase	1.48	1.07 to 2.05	0.03	1.22	0.85 to 1.74	0.2
Exploring the contribution of administrative barriers (e.g., delay in VA claim approval) to the development and perpetuation of chronic pain. (Q36)	Age	Every 10-year increase	1.00	0.77 to 1.30	0.8	1.00	0.78 to 1.29	0.8
	Gender	Male	1.48	0.74 to 2.95	0.3	1.51	0.76 to 3.02	0.2
	Gross income level	≤ \$79,000	0.64	0.37 to 1.11	0.1	---	---	---
	Final rank while in the military	Non-Officer	1.27	0.73 to 2.22	0.4	---	---	---
	Years since release from the military	Every 10-year increase	1.11	0.84 to 1.46	0.5	---	---	---
Establishing the effectiveness of chiropractic care for chronic pain. (Q37)	Age	Every 10-year increase	1.00	0.82 to 1.22	0.8	0.34	0.28 to 0.42	0.9
	Gender	Male	0.88	0.52 to 1.50	0.6	0.84	0.49 to 1.46	0.5
	Gross income level	≤ \$79,000	0.56	0.35 to 0.89	0.02	0.57	0.36 to 0.91	0.02
	Final rank while in the military	Non-Officer	0.82	0.51 to 1.33	0.4	---	---	---
	Years since release from the military	Every 10-year increase	0.95	0.76 to 1.19	0.6	---	---	---
Establishing the effectiveness of medical cannabis for	Age	Every 10-year increase	0.68	0.54 to 0.85	0.001	0.68	0.54 to 0.85	0.001
	Gender	Male	1.19	0.70 to 2.03	0.5	1.08	0.63 to 1.87	0.8

chronic pain. (Q38)	Gross income level	≤ \$79,000	0.95	0.60 to 1.51	0.8	---	---	---
	Final rank while in the military	Non-Officer	1.56	0.97 to 2.51	0.07	---	---	---
	Years since release from the military	Every 10-year increase	0.86	0.69 to 1.08	0.2	---	---	---
Reducing the use of opioids for chronic pain. (Q39)	Age	Every 10-year increase	1.00	0.81 to 1.23	1.0	1.00	0.81 to 1.23	1.0
	Gender	Male	1.12	0.63 to 1.99	0.7	1.11	0.62 to 1.98	0.7
	Gross income level	≤ \$79,000	1.02	0.62 to 1.67	0.9	---	---	---
	Final rank while in the military	Non-Officer	0.94	0.57 to 1.57	0.8	---	---	---
	Years since release from the military	Every 10-year increase	0.95	0.75 to 1.20	0.6	---	---	---
Effectiveness of providing treatment decision aids (evidence summaries conveying benefits and harms of different therapeutic options) to veterans living with chronic pain. (Q42)	Age	Every 10-year increase	1.11	0.89 to 1.37	0.4	1.11	0.90 to 1.36	0.4
	Gender	Male	1.11	0.62 to 2.00	0.7	1.15	0.64 to 2.08	0.6
	Gross income level	≤ \$79,000	0.66	0.40 to 1.08	0.1	---	---	---
	Final rank while in the military	Non-Officer	1.17	0.71 to 1.95	0.5	---	---	---
	Years since release from the military	Every 10-year increase	1.11	0.89 to 1.37	0.4	---	---	---

\* For the purposes of analysis, this variable is dichotomized. The reference category is those with a gross income level ≤ median, and the other category is those with a gross income level > median.

† For the purposes of analysis, this variable is dichotomized. The reference category is Non-Officer (includes Junior non-commissioned member, senior non-commissioned member and Recruit), and the other category is Officer (includes Officer, Warrant officer, and Petty officer).

### **3.5.5. Thematic analysis**

Written comments were provided by almost half of respondents (147 of 313; 47%), which revealed 5 themes: (i) enthusiasm for studying specific therapeutic interventions (e.g., osteopathy, acupuncture, yoga, meditation), (n = 19; 6.1%); (ii) administrative barriers to care through Veterans Affairs Canada, (n = 10; 3.2%); (iii) challenges with civilian healthcare providers (n = 9; 2.9%); (iv) barriers to care after release from the military (n = 6; 1.9%); and (v) understanding the impact of chronic pain on certain subgroups (e.g., different military ranks, women, family), (n = 6; 1.9%), (**Additional file 4**). No subtheme was endorsed by more than 5 respondents.

## **3.6. DISCUSSION**

### **3.6.1. Main findings**

Our survey found strong support for several research themes among Canadian veterans living with chronic pain. Leading priorities included improving chronic pain management after discharge from the military, and the identification and treatment of mental illness among military veterans living with chronic pain. More women than men endorsed chronic pain prevention through the optimization of post-surgical care, as well as endorsing research into the effectiveness of holistic care for chronic pain. Conversely, more men than women endorsed investigation into the effectiveness of physical activity or exercise for chronic pain. Individuals with a gross income  $\geq$ \$80,000 were less likely to endorse physiotherapy or chiropractic for chronic pain. Age was found to significantly predict the endorsement of research into the

effectiveness of medical cannabis for chronic pain, as with every 10-year increase in age, the endorsement for this research priority decreases.

### **3.6.2. Relation to other studies**

There is a lack of information from the literature on establishing research priorities for military veterans living with chronic pain. The Canadian Pain Task Force included veterans as a population that is disproportionately impacted by pain and emphasized the need for research that considered gender and sex differences in response to treatment, risk and protective factors for the development of chronic pain, and the unique circumstances that veterans encounter in relation to development and management of chronic pain [5].

A recent Canadian study on adults living with chronic pain identified four themes of research priorities: (i) improving knowledge of chronic pain among healthcare providers and communities, as well as improving the competency of healthcare providers in treating chronic pain; (ii) the prevention of chronic pain and chronic pain-related symptoms; and research directed towards the (iii) treatment and assessment of patient-centered chronic pain care, as well as (iv) improving the access and coordination of patient-centered chronic pain care [12]. Our survey confirmed support for these research priorities and identified additional areas endorsed by veterans living with chronic pain, including the impact of co-morbid mental illness, studying barriers to pain management in the military, and optimizing engagement with civilian healthcare providers after release.

Age, gender, and gross income level were found to impact the likelihood of the endorsement of certain therapy-related research priorities. With increase in age, endorsement for research into medical cannabis became less likely. Similarly, a study found that military veterans from an older age group (45-64 years) had lower instances of 6-month cannabis use or cannabis

use disorder compared to a younger age group (18-44 years) [13]. Moreover, more women than men prioritized research towards establishing the effectiveness of holistic care for chronic pain.

A study found that more female than male military veterans are seeking out services to meet their mental and psychological needs for their chronic pain-related care, such as psychotherapy and mental health assessments [14]. A need for such services may predispose women to seek out research that will substantiate the use of holistic care for chronic pain.

In the case of the other four forthcoming results from our regression analyses, there is currently not any prior literature to provide further insight into these findings. Women are more likely than men to prioritize research into optimizing post-surgical care for chronic pain. Compared to men, women report greater intensity of post-surgical pain [15] and are more likely to report acute post-procedural pain [16] and have higher incidence of severe pain episodes [17]. Moreover, women are less likely to receive adequate analgesia after surgery, which may increase their risk for under-treatment after surgery [18]. These experiences may be implicated in women expressing greater interest in optimizing post-surgical care compared to men.

Men were more likely than women to prioritize research towards establishing the effectiveness of physical activity or exercise for chronic pain. In patients with chronic pain, women score less than men on physical functioning [19]. Moreover, women with chronic pain are more likely to report pain catastrophizing and greater pain [20], as well as lower self-efficacy compared to men [21]. Altogether, these experiences may pre-dispose women to have less interest compared to men in active strategies such as physical activity or exercise to manage pain.

Individuals with a higher gross income level were less likely to endorse research towards establishing the effectiveness of physiotherapy or chiropractic for chronic pain, compared to



those with a lower gross income level. A study in one clinic found that the typical chiropractic patient was overwhelmingly unemployed (86%;  $N = 1803$ ), and hence this may translate to having lower gross income [22]. Furthermore, physiotherapy and chiropractic are not covered by the Government of Canada, and largely become out-of-pocket expenses if patients do not have insurance benefits to cover such services. While the “Programs of Choice 12 – Related Health Services” from Veterans Affairs (VA) Canada provides coverage for chiropractic and physiotherapy to military veterans, a physician must prescribe such a service prior to it being approved by VA Canada [23]. Those patients that have less income and have not received physician approval to utilize physiotherapy or chiropractic may be more interested in prioritizing research that substantiates the efficacy of such services in reducing chronic pain, which may then influence payers such as government stakeholders to consider at least partially covering the expenses for these treatment options and may also influence physicians to be more inclined in prescribing such services.

### **3.6.3. Strengths and limitations**

The strengths of our study include pre-testing our survey, providing our survey in English and French (Canada’s two official languages), use of closed-ended response options, and reminders to potential participants to increase response rate. Our study also has limitations. Our sample did not include ex-members of the RCMP, which are considered by Canada to be veterans, and our results may not apply to this group. Moreover, our participants were veterans that expressed interest in research and willingness to be included in the mailing list of the Chronic Pain Centre of Excellence for Canadian Veterans which may have introduced selection bias. Further, our response rate of 45% may have also introduced selection bias. Also, we did not collect data on

mental illness or other comorbidities, nor data on types and location of chronic pain, and hence we are unable to make conclusions on how these factors may influence the endorsement of the research priorities.

#### **3.6.4. Conclusion**

A large majority of Canadian veterans living with chronic pain endorsed all 20 research priorities they were presented with as important, with the most enthusiasm for optimization of chronic pain care after discharge, exploring the effectiveness of self-care, and the importance of identifying and treatment co-morbid mental illness. Women were more likely to endorse research into post-surgical care or holistic care for chronic pain, while men were more likely to endorse research into physical activity or exercise for chronic pain. Endorsement for research into medical cannabis for chronic pain decreased with increase in age. Military veterans with a gross income level of  $\geq$ \$80,000 were less likely to endorse research into physiotherapy or chiropractic care for chronic pain. Our findings provide insight into the research priorities of Canadian military veterans living with chronic pain. These results should be considered by granting agencies when formulating calls for proposals, and by researchers who wish to undertake research that will address the needs of Canadian military veterans living with chronic pain.

#### **3.7. ETHICS DECLARATION**

HiREB waived the ethics review of this study as this survey was for a quality improvement initiative with no initial intent to publish.

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### 3.9. SUPPLEMENTARY MATERIAL

#### Additional file 1. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Checklist.

Item	Item No.	Recommendation	Page in the Manuscript
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2,3
Objectives	3	Specific objectives, including any prespecified hypotheses	3
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	2,3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2,3
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	2,3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4,5
Data sources/measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4,5
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	5
		(b) Describe any methods used to examine subgroups and interactions	5
		(c) Explain how missing data were addressed	4
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Figure 1

		(b) Give reasons for non-participation at each stage	5,6; Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Tables 1,2
		(b) Indicate number of participants with missing data for each variable of interest	Tables 1,2,3,4, Additional files 2,3
Outcome data	15	Report numbers of outcome events or summary measures	6,7,8
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	4,5
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10, 11
Generalisability	21	Discuss the generalisability (external validity) of the study results	12
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12



**Additional file 2.** English and French versions of the survey.

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Research Priorities of Veterans living with Chronic Pain

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Dear \_\_\_\_\_,

I am the Director of Research for the Chronic Pain Centre of Excellence for Canadian Veterans, and our group is conducting a study on research priorities of military veterans living with chronic pain.

The results of this study will help researchers identify the areas that future research should focus on, so that it aligns with the priorities of military veterans living with chronic pain.

Following this cover page is a 45-question survey which should take between 15 to 20 minutes to complete. These questions are based on a series of interviews that explored research priorities for military veterans living with chronic pain. Prior to the actual survey, there are two questions to assess your eligibility for completion of the survey.

If you feel there are important research topics that are not highlighted in this survey, we would request that you indicate these topics in a written response to the last question.

If you have any questions or concerns at any point regarding the survey, please feel free to contact me through email ([bussejw@mcmaster.ca](mailto:bussejw@mcmaster.ca)).

Thank you very much for your time and assistance.

Sincerely,

Jason Busse  
Associate Professor, Dept. of Anaesthesia  
McMaster University

## Screening Questions

We would like to first ask you two questions to determine your eligibility for completing the survey.

I. Are you a military veteran?

- Yes
- No

II. Do you live with chronic pain?

*Chronic pain is defined as pain that has persisted for 3 months or more.*

- Yes
- No

## Demographic Questions

1. What is your gender?  Female

- Male
- Another Gender Identity
- Prefer not to answer

2. What is your age? \_\_\_\_\_

3. In which country/countries have you served in the military (check all that apply)?

- Canada
- United States of America
- United Kingdom
- Australia
- Other: \_\_\_\_\_

4. What branch(s) of the military did you serve in (check all that apply)?

- Air Force
- Army
- Marines
- Navy
- Special Forces
- Other: \_\_\_\_\_

5. What was your final rank in the military?

- Officer
- Warrant officer
- Junior non-commissioned member
- Senior non-commissioned member
- Recruit

Other: \_\_\_\_\_

6. What component of the military were you a part of?

Guard

Regular (or Active) Force

Reserve Force – Primary

Reserve Force – Supplementary

Reserve Force – Cadet Organizations Administration and

Training

Service

Reserve – Rangers

Other: \_\_\_\_\_

7. Which of the following best describes the primary focus of your occupational specialty in the military?

Operational or Combat-related

Operational support (i.e., Non-operational or non-combat related positions that assisted operational or combat-related forces to deliver their mission).

Institutional support (i.e., Non-operational or non-combat related positions that were not involved in assisting operational or combat-related forces directly; e.g., base/wing positions, support for educational institutions)

Other: \_\_\_\_\_

8. How many years did you serve in the military?: \_\_\_\_\_

9. How many years has it been since you were discharged from the military? \_\_\_\_\_

10. What is your current province or territory of residence?

Ontario

Manitoba

Quebec

Nova Scotia

New Brunswick

Prince Edward Island

Newfoundland and Labrador

Saskatchewan

Alberta

British Columbia

Yukon

Northwest Territories

Nunavut

Other: \_\_\_\_\_

11. Who do you presently live with (check all that apply)?

- Spouse/Partner
- Children
- Caregiver
- Grandchildren
- Parent(s)
- Roommate(s)
- Friend(s)
- No one, I live alone

12. What best describes your current region of residence?

- Urban (in the city)
- Rural (in the country)
- Suburban (mixed-use or residential area, existing either as part

of a city area or

as a separate residential community within commuting distance of a city)

Other: \_\_\_\_\_

13. What best describes your current housing situation?

- Own property
- Rent property
- Other: \_\_\_\_\_

14. What best describes your current employment status?

- Employed, full-time
- Employed, part-time
- Unemployed
- Unemployed, and receiving disability benefits
- Retired
- Other: \_\_\_\_\_

15. What best describes your current gross income level?

- Below \$25,000
- \$25,000 to \$49,000
- \$50,000 to \$59,000
- \$60,000 to \$79,000
- \$80,000 to \$99,000
- \$100,000 to \$150,000
- More than \$150,000

16. How many people does your current gross income support (including yourself)?

\_\_\_\_\_

17. Which of the following best describes your race or ethnicity?:

- Asian – East (e.g. Chinese, Japanese, Korean)
- Asian – South (e.g. Indian, Pakistani, Sri Lankan, Indo-Caribbean/West Indian)
- Asian – Southeast (e.g. Malaysian, Filipino, Vietnamese, Cambodian)
- Asian – West (e.g. Afghanistani, Israeli, Saudi Arabian, Iranian, Turkish)
- Australasian – (e.g. Australia, New Zealand, New Guinea, Melanesia)
- Black – Africa (e.g. Ghanaian, Kenyan, Somali)
- Black – North America
- Black – Caribbean Region (e.g. Barbadian, Jamaican)
  - Hispanic
- Indigenous (e.g. Inuit, First Nations, Non-Status Indian, Metis, Indigenous person from outside Canada)
  - Latin American (e.g. Argentinean, Chilean, Salvadoran)
  - White/European (e.g. English, Italian, Portuguese, Russian)
  - Prefer not to answer
  - Do not know
  - Other: \_\_\_\_\_

18. What is your highest formal education level?

- Elementary School
- High School
- University Degree
- College Degree
- Other: \_\_\_\_\_

19. What best describes your current relationship status?

- Single/Never Married
- Married
- Common law
- Separated
- Divorced
- Widowed

20. How many years have you lived with chronic pain? \_\_\_\_\_

21. How often do you include chronic pain as a part of a claim that you submit to Veterans Affairs Canada?

- All of the time
- Most of the time
- Sometimes
- Rarely
- Never
- I have never filed a claim to Veterans Affairs Canada

22. How would you rate your satisfaction with your current chronic pain care?

Very satisfied    Somewhat satisfied    Unsure    Somewhat unsatisfied    Very unsatisfied

### Research Priorities Survey

The following questions seek to understand your priorities for chronic pain research. There are no right or wrong answers. Please answer based on your own experiences and opinions.

23. How important is research into improving **acute** pain (<1 month in duration) care while in the military to reduce the risk of developing chronic pain?

Very important    Somewhat important    Unsure    Somewhat unimportant    Very unimportant

24. How important is research into improving **chronic** pain ( $\geq 3$  months duration) care while in the military?

Very important    Somewhat important    Unsure    Somewhat unimportant    Very unimportant

25. How important is research into addressing barriers to **chronic** pain management within the military (e.g., stigma, lack of knowledge, inadequate treatment options or access to care)?

Very important    Somewhat important    Unsure    Somewhat unimportant    Very unimportant

26. How important is research into improving health care for chronic pain management after release from the military (e.g., improving access to a civilian family doctor)?

Very important    Somewhat important    Unsure    Somewhat unimportant    Very unimportant

27. How important is research into reducing the length of time for chronic pain claims to be adjudicated by Veterans Affairs Canada?

Very important    Somewhat important    Unsure    Somewhat unimportant    Very unimportant

28. How important is research into improving civilian doctors' knowledge of military life and the impact of military service as relates to the development of chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

29. How important is research into understanding risk factors during military service that are associated with the development of chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

30. How important is research into optimizing post-surgical care to prevent the development of chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

31. How important is research into establishing the effectiveness of physiotherapy for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

32. How important is research into establishing the effectiveness of massage therapy for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

33. How important is research into establishing the effectiveness of physical activity/exercise for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

34. How important is research into establishing the effectiveness of holistic care (e.g., addressing all relevant factors, not just pain, such as mental health, financial health and quality of life) for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

35. How important is research into establishing the effectiveness of self-care (i.e., what patients can do for themselves) for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

36. How important is research into exploring the contribution of administrative barriers (e.g., delay in VA claim approval) to the development and perpetuation of chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

37. How important is research into establishing the effectiveness of chiropractic care for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

38. How important is research into establishing the effectiveness of medical cannabis for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

39. How important is research into reducing the use of opioids for chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

40. How important is research into identifying mental illness among veterans living with chronic pain?



Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

41. How important is research into treatment of mental illness among veterans living with chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

42. How important is research into the effectiveness of providing treatment decision aids (evidence summaries conveying benefits and harms of different therapeutic options) to veterans living with chronic pain?

Very important     Somewhat important     Unsure     Somewhat unimportant     Very unimportant

43. From the research priorities listed, which one would be your overall **top** priority?

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44. From the research priorities listed, which one would be your overall **lowest** choice priority?

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45. Is there a research priority not mentioned that you think should be included? Please explain.

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**End of Survey**

**Thank you for your time! If you have any further questions please contact Jason Busse at:**  
[bussejw@mcmaster.ca](mailto:bussejw@mcmaster.ca)

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Priorités de Recherche pour des Vétérans Souffrant de Douleur Chronique

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Cher/ Chère \_\_\_\_\_,

Je suis le directeur de la recherche au Centre d'excellence sur la douleur chronique pour les vétérans canadiens/ canadienne, et notre groupe mène une étude sur les priorités de recherche des vétérans souffrant de douleur chronique.

Les résultats de cette étude aideront les chercheurs à identifier les domaines sur lesquels la recherche future devrait se concentrer, afin qu'elle corresponde aux priorités des vétérans.

À la suite de cette page de couverture se trouve un sondage de 42 questions qui devrait prendre environ [xx] minutes. Ces questions sont basées sur une série d'entrevues qui ont exploré les priorités de recherche pour les anciens combattants souffrant de douleur chronique. Avant le sondage, nous vous demandons de répondre à deux questions pour évaluer votre admissibilité à répondre au sondage.

Si vous pensez qu'il y a des sujets de recherche importants qui ne sont pas mis en évidence dans cette enquête, nous vous demandons de les indiquer dans une réponse écrite à la dernière question.

Si vous avez des questions à tout moment concernant le sondage, n'hésitez pas à me contacter par courriel ([bussejw@mcmaster.ca](mailto:bussejw@mcmaster.ca)).

Merci beaucoup pour votre coopération.

Cordialement,

Jason Busse  
Professeur Agrégé, Département d'Anesthésie  
Université de McMaster

**Questions de Sélection**

Nous voulons vous poser deux questions pour déterminer votre éligibilité pour répondre au sondage.

I. Êtes-vous un vétéran militaire?

- Oui  
 Non

II. Vivez-vous avec une douleur chronique?

*La douleur chronique est définie comme une douleur qui persiste pendant une période d'au moins 3 mois.*

- Oui  
 Non

### Questions Démographiques

1. Quel est votre genre?:  Femme

- Homme  
 Une autre identité de genre  
 Préfère ne pas répondre

2. Quel âge avez-vous? \_\_\_\_\_

3. Quel est votre pays de naissance?:

- Canada  
 Les Etats Unis  
 Autre: \_\_\_\_\_

4. Quel était votre rôle dans la militaire?

- Soldat(e)  
 Officier de Police  
 Technicien(ne)  
 Commis Militaire  
 Autre: \_\_\_\_\_

5. Combien d'années avez-vous servi dans la militaire?: \_\_\_\_\_

6. Depuis combien d'années vous êtes démobilisé de la militaire? \_\_\_\_\_

7. Quelle est votre province ou territoire de résidence?

- Ontario  
 Manitoba  
 Québec

- Nouvelle-Écosse
- Nouveau-Brunswick
- Île-du-Prince-Édouard
- Terre-Neuve-et-Labrador
- Saskatchewan
- Alberta
- Colombie-Britannique
- Yukon
- Territoires du nord-ouest
- Nunavut
- Autre: \_\_\_\_\_

8. Avec qui vivez-vous maintenant?  
(cochez toutes qui applique)
- Épouse/ Époux ou Partenaire
  - Enfants
  - Soignant(e)
  - Petits Enfants
  - Parent(es)
  - Camarade(s) de Chambre
  - Ami(s)
  - Seule

9. lequel des énoncés suivants décrit le mieux votre région de résidence?
- Urbain (en ville)
  - Rural (dans le pays)
  - Banlieue (zone à usage mixte ou résidentielle, existant dans le cadre d'une zone urbaine ou en tant que communauté résidentielle distincte à une distance proche d'une ville)
- Autre: \_\_\_\_\_

10. Ce qui décrit le mieux votre situation actuelle en matière de logement?
- Propre propriété
  - Propriété louer
  - Autre: \_\_\_\_\_

11. Lequel des énoncés suivants décrit le mieux votre situation professionnelle?
- Employé à temps complet
  - Employé, à temps partiel

- Sans emploi
- Sans emploi, et recevoir des bénéficiaires de prestations d'invalidité
- Retraité(e)
- Autre: \_\_\_\_\_

12. Lequel des énoncés suivants décrit le mieux votre niveau de revenu brut actuel?

- Moins de 25 000 \$
- 25 000 \$ à 49 000 \$
- 50 000 \$ à 59 000 \$
- 60 000 \$ à 79,000 \$
- 80 000 \$ à 99 000 \$
- 100 000 \$ à 150 000 \$
- Plus de 150 000 \$

13. Combien de personnes votre revenu actuel soutient-il (y compris vous-même)?

\_\_\_\_\_

14. Lequel des énoncés suivants décrit le mieux votre race ou votre appartenance ethnique?:

- Asie - Est (par exemple chinois, japonais, coréen)
- Asie - Sud (par exemple, indienne, pakistanaise, sri-lankaise, indo-caribéenne / antillaise)
- Asie - Sud-est (par exemple malais, philippin, vietnamien, cambodgien)
- Asie - Ouest (par exemple, Afghanistani, israélien, saoudien, iranien, turc) - -
- Australasie - (par exemple, Australie, Nouvelle-Zélande, Nouvelle-Guinée, Mélanésie) -
- Noir - Afrique (par exemple, ghanéen, kenyan, somalien)
- Noir – Amérique du Nord
- Noir - Région des Caraïbes (par exemple, Barbadienne, Jamaïcaine)
- Hispanique
- Autochtones (p. Ex., Inuits, Premières nations, Indiens non inscrits, Métis, Autochtones personne de l'extérieur du Canada)
- Amérique latine (par exemple argentin, chilien, salvadorien)
- Européen (par exemple anglais, italien, portugais, russe)
- Préfère ne pas répondre
- Ne sait pas
- Autre: \_\_\_\_\_

15. Quel est votre niveau d'éducation formelle le plus élevé??

- École primaire
- Ecole Secondaire

- Diplôme universitaire
- Diplôme de collège
- Autre: \_\_\_\_\_

16. Lequel des énoncés suivants décrit le mieux l'état de votre relation?

- Seule/ jamais marié
- Marié
- Loi commune
- Séparé(e)
- Divorcé(e)
- Veuf/ veuve

17. Combien d'années avez-vous vécu avec une douleur chronique? \_\_\_\_\_

18. Avez-vous déjà présenté une demande de règlement pour douleur chronique à Anciens Combattants Canada?

- Non, je n'ai jamais déposé de réclamation
- Oui, j'ai déposé une réclamation

19. Comment évalueriez-vous votre satisfaction à l'égard de vos soins actuels contre la douleur chronique?

- Très satisfait
- Plutôt satisfait
- Incertain(e)
- Plutôt insatisfait
- Très insatisfait

### Sondage sur les Priorités de Recherche

Les questions suivantes visent à comprendre vos priorités de recherche concernant les anciens combattants et la douleur chronique. Il n'y a pas de bonnes ou de mauvaises réponses. Veuillez répondre en fonction de vos propres expériences et opinions.

20. Quelle est l'importance de la recherche sur l'amélioration des soins de la douleur **aiguë** (d'une durée  $1 >$  mois) dans l'armée afin d'éviter le développement de la douleur chronique?

- Très important
- Assez important
- Incertain(e)
- Sans importance
- vraiment sans importance

21. Quelle est l'importance de la recherche pour améliorer les soins de la douleur **chronique** (d'une durée  $\geq 3$  mois) pendant que vous êtes dans l'armée?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

22. Quelle est l'importance de la recherche pour éliminer les obstacles à la gestion de la douleur **chronique** au sein de l'armée (p. Ex., Stigmatisation)?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

23. Quelle est l'importance de la recherche sur l'amélioration des soins de santé pour la gestion de la douleur chronique après la libération de l'armée (p. Ex., L'amélioration de l'accès à un médecin de famille civil)?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

24. Dans quelle mesure la recherche est-elle importante pour réduire la durée pendant laquelle les demandes de remboursement de la douleur chronique doivent être traitées par Anciens Combattants Canada?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

25. Quelle est l'importance de la recherche pour améliorer les connaissances des médecins civils sur la vie militaire et l'impact du service militaire sur le développement de la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

26. Quelle est l'importance de la recherche sur la compréhension des facteurs de risque pendant le service militaire qui sont associés au développement de la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

27. Quelle est l'importance de la recherche sur l'optimisation des soins post-chirurgicaux pour prévenir le développement de la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

28. Quelle est l'importance de la recherche pour établir l'efficacité de la physiothérapie contre la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

29. Quelle est l'importance de la recherche pour établir l'efficacité de la massothérapie contre la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

30. Quelle est l'importance de la recherche pour établir l'efficacité de l'activité physique / de l'exercice contre la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

31. Dans quelle mesure la recherche est-elle importante pour établir l'efficacité des soins holistiques (p.ex., traiter tous les facteurs pertinents, et pas seulement la douleur, comme la santé mentale, la santé financière et la qualité de vie) pour la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

32. Quelle est l'importance de la recherche pour établir l'efficacité des autosoins (ce que les patients peuvent faire pour eux-mêmes) pour la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

33. Dans quelle mesure la recherche est-elle importante pour explorer la contribution des barrières administratives (par exemple: retard dans l'approbation des demandes d'AV) au développement et à la perpétuation de la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance



34. Quelle est l'importance de la recherche pour établir l'efficacité des soins chiropratiques pour la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

35. Quelle est l'importance de la recherche pour établir l'efficacité du cannabis médical contre la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

36. Quelle est l'importance de la recherche pour réduire l'utilisation d'opioïdes pour la douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

37. Quelle est l'importance de la recherche sur l'identification de la maladie mentale chez les anciens combattants souffrant de douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

38. Quelle est l'importance de la recherche sur le traitement de la maladie mentale chez les anciens combattants souffrant de douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

39. Quelle est l'importance de la recherche sur l'effet de la preuve des avantages et des inconvénients des options de traitement disponibles pour les anciens combattants souffrant de douleur chronique?

Très important  Assez important  Incertain(e)  Sans importance  vraiment sans importance

40. Parmi les priorités de recherche répertoriées, laquelle serait votre **priorité absolue**?

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41. Parmi les priorités de recherche répertoriées, laquelle serait votre **priorité de choix la plus basse**?

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42. Y a-t-il une priorité de recherche non mentionnée qui, selon vous, devrait être incluse? S'il vous plaît, expliquez.

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**Fin du Sondage**

**Merci pour votre temps! Si vous avez d'autres questions, veuillez contacter Jason Busse à: [bussejw@mcmaster.ca](mailto:bussejw@mcmaster.ca)**

**Additional file 3.** Responses to the question on the overall top priority and overall lowest priority item from the 45-item survey.

<b><u>Research Priority identified from the Survey Question</u></b>	<b><u>Overall Top Priority</u></b> (n=308)	<b><u>Overall Lowest Priority</u></b> (n=306)
Improving acute pain (<1 month in duration) care while in the military to reduce risk of developing chronic pain. (Q23)	21 (7%)	28 (9%)
Improving chronic pain (≥3 months duration) care while in the military. (Q24)	33 (11%)	9 (3%)
Addressing barriers to chronic pain management within the military (e.g., stigma, lack of knowledge, inadequate treatment options or access to care). (Q25)	29 (9%)	9 (3%)
Improving health care for chronic pain management after release from the military (e.g., improving access to a civilian family doctor). (Q26)	52 (17%)	4 (1%)
Reducing the length of time for chronic pain claims to be adjudicated by Veterans Affairs Canada. (Q27)	26 (8%)	6 (2%)
Improving civilian doctors' knowledge of military life and the impact of military service as it relates to the development of chronic pain. (Q28)	28 (9%)	19 (6%)
Understanding risk factors during military service that are associated with the development of chronic pain. (Q29)	7 (2%)	11 (4%)
Optimizing post-surgical care to prevent the development of chronic pain (Q30)	2 (1%)	20 (7%)
Establishing the effectiveness of physiotherapy for chronic pain. (Q31)	0 (0%)	4 (1%)
Establishing the effectiveness of massage therapy for chronic pain. (Q32)	6 (2%)	9 (3%)
Establishing the effectiveness of physical activity/exercise for chronic pain. (Q33)	3 (1%)	6 (2%)
Establishing the effectiveness of holistic care (e.g., addressing all relevant factors, not just pain, such as mental health, financial health and quality of life) for chronic pain. (Q34)	20 (6%)	15 (5%)
Effectiveness of self-care (i.e., what patients can do for themselves) for chronic pain. (Q35)	10 (3%)	5 (2%)
Exploring the contribution of administrative barriers (e.g., delay in VA claim approval) to the development and perpetuation of chronic pain. (Q36)	9 (3%)	20 (7%)
Establishing the effectiveness of chiropractic care for chronic pain. (Q37)	0 (0%)	39 (13%)
Establishing the effectiveness of medical cannabis for chronic pain. (Q38)	9 (3%)	36 (12%)
Reducing the use of opioids for chronic pain. (Q39)	9 (3%)	34 (11%)
Identifying mental illness among veterans living with chronic pain. (Q40)	18 (6%)	7 (2%)
Treatment of mental illness among veterans living with chronic pain. (Q41)	18 (6%)	3 (1%)
Effectiveness of providing treatment decision aids (evidence summaries conveying benefits and harms of different therapeutic options) to veterans living with chronic pain. (Q42)	8 (3%)	22 (7%)

**Additional file 4.** Findings from a thematic analysis based on open-ended responses to a question on the 45-item survey (Question #45), (N = 147).\*

<b>Theme</b>	<b>Subtheme</b>	<b>Endorsements</b>	<b>Research Priority</b>	<b>Exemplary Quotation</b>
Therapeutic interventions	Osteopathy	4 (2 M, 2 F)	Establishing the effectiveness of osteopathy for the treatment of chronic pain.	<i>“I discovered osteopathy and it was this treatment above all others, massage therapy, physiotherapy, and acupuncture that made a dramatic difference with helping me to manage my pain and to move forward in my recovery. Please include this as a form of treatment. It is well known in Germany and France and yet, here in Canada this modality is not very well known.”</i>
	Acupuncture	5 (3 M, 2 F)	Establishing the effectiveness of acupuncture for the treatment of chronic pain	<i>“Acupuncture... are all important to study. The first two are most important to me...”</i>
	Occupational therapy	2 (1 M, 1 F)	Establishing the effectiveness of occupational therapy for the treatment of chronic pain	<i>“Occupational therapy, specifically treatment utilizing the dolphin pen. I have experienced great success from this form of therapy.”</i>
	Surgery	2 (2 M, 0 F)	Increasing the accessibility and/or availability of surgery for chronic pain	<i>“How about surgical options, if I lived in Europe I could have my back repaired and live a long pain free life, not here though.”</i>
	Yoga	2 (2 M, 0 F)	Establishing the effectiveness of different forms of yoga (power yoga, somatic yoga) for the treatment of chronic pain	<i>“Research the effects of Yoga...while dealing with chronic pain.”</i>
	Meditation	2 (2 M, 0 F)	Establishing the effectiveness of meditation for the treatment of chronic pain	<i>“Research the effects of ...meditation while dealing with chronic pain.”</i>
	Group-based approach to chronic pain management	2 (0 M, 2 F)	Establishing the effectiveness of group-based support for chronic pain management	<i>“The effect of a group approach to dealing with and living with chronic pain (how socialization is key in the development of both mental and physical health).”</i>
Administrative Issues involving VA	Barriers arising from VA when accessing adequate chronic pain-related care	3 (1 M, 2 F)	Reducing VA-related barriers to delivery of chronic pain care	<i>“Providing solutions for people like myself who have been suffering for decades and have had to fight VAC every step of the way.”</i>

	Receptiveness of VA to cover a broader range of pain treatment options	4 (2 M, 2 F)	Increasing the types of chronic pain treatments covered by VA	<i>“I found in the military my options were physio, or more physio. If I wanted to see a chiropractor, I had to pay for that on my own. We could be told it was under our scope of care, but we were not allowed to engage that option.”</i>
	Continuation of medical care after release	3 (2 M, 1 F)	Establishing effective transfer of veterans’ medical records from VA to health professionals	<i>“Research into continued medical support after release. I have been out for over a year and still can’t find a medical doctor to fill out my increasing paperwork. Causes me more anxiety and undue stress!”</i>
Competency Issues of Civilian Healthcare Staff	Enhancing civilian doctor knowledge of and training with dealing with VA	2 (1 M, 1 F)	Education/training for civilian doctors on interacting with VA for information relevant to veterans’ care	<i>“When you go to your family doctor they have no idea in how to deal with the veterans affairs and because of this I get very poor service from them and it isn’t there fault. There should be more help and training for them”</i>
	Improving opioid prescription habits of doctors to military veterans with chronic pain	2 (2 M, 1 F)	Education/training for civilian doctors on healthy opioid prescription for military veterans with chronic pain	<i>“The over prescription of various drugs to reduce chronic pain ie antidepressants etc”</i>
	Identifying civilian doctors that are adequately trained in treating and caring for military veterans	2 (2 M, 0 F)	Providing support for veterans lacking civilian doctors trained to treat/care for military veterans	<i>“All the doctors I have met, look at me with disbelief and all they suggest to shut me up, is take Tylenol. Is it because family doctors should be trained to recognize my needs?”</i>
	Need for follow-up medical	3 (3 M, 0 F)	Establishing routine follow-ups on health conditions of veterans and medical report update	<i>“How about instituting a program were a person actually reaches out to the veteran as part as a follow up to the care given to them. The doctors are so busy that don’t have enough time to contact”</i>

	appointments for veterans			
Barriers to the accessibility of quality care	Need for military veteran-oriented pain management clinic	2 <b>(2 M, 0 F)</b>	Increasing the accessibility and/or availability of a pain management clinic dedicated to treating military veterans	<i>"I am a firm believer in the fact the Ontario should have a Veterans Hospital, and doctors and nurses."</i>
	Remote, rural or northern areas or isolated areas that lack vicinities for chronic pain management.	2 <b>(2 M, 0 F)</b>	Increasing the accessibility of chronic pain-related care in remote, rural, northern or isolated areas.	<i>"Research into regional barriers affecting acute pain management, chronic pain management and mental health management. ie. Remote or far northern postings, even provincial differences in receiving treatment and effective management"</i>
	COVID-19 related inaccessibility to chronic pain-related care	2 <b>(2 M, 0 F)</b>	Assessing the effect of COVID-19 restrictions on accessibility to chronic pain treatment	<i>"Due to COVID-19 the VA Qualified doctors who can assess my condition and are familiar with the military are inaccessible as they are closed to us"</i>
Impact of chronic pain on subgroups	Military rank-based differences in the type(s) of chronic pain	2 <b>(2 M, 0 F)</b>	Assessing the variety of chronic pain manifestations in relation to military ranks	<i>"I would like to see research into the types of chronic pain (ie. back, knees, disease causing chronic pain, etc) and its relation to the types of trades within the military. Meaning, is an Infantry Soldier in the Army more likely to develop chronic pain in his back than say an Airforce Pilot?"</i>
	Focus on chronic pain experience of women	2 <b>(0 M, 2 F)</b>	Examining the factors that contribute to chronic pain experience of women veterans	<i>"Chronic pain and gender related issues: biological, physiological, experiential and environmental military life and its effects on women). Too often research is done on men and extrapolated to women and it denies women their own experiences, health and well-being and opportunities for improvement."</i>
	Effects of chronic pain on the family	2 <b>(2 M, 0 F)</b>	Determining the impact of chronic pain on veterans' family members	<i>"Effects on family members that have to take care/live with us."</i>

\* VA = Veterans Affairs; COVID-19 = coronavirus disease of 201

## **CHAPTER 4 – Thesis Conclusion**

### **4.1 THESIS CONCLUSION**

This dissertation underscored two aspects with regards to chronic pain in military veterans. Specifically, low certainty evidence suggests that the overall prevalence of CNCP among military veterans is 43%; however, there is still considerable unexplained variability between studies, and hence this pooled estimate may change with additional research. Future research would benefit from improved participant retention, systematic assessment of chronic pain among all participants, and employing a standardized definition of CNCPb. Second, from among 20 research priorities that were investigated, the majority of military veterans living with chronic pain endorsed the importance of all priorities; however, post-discharge chronic pain management and identifying and treating co-morbid mental health issues were almost universally endorsed. Several therapy-related research priorities had predictors that impacted their likelihood. As age increased, individuals were less likely to endorse research into medical cannabis for chronic pain. Women were more likely to endorse research into the optimization of post-surgical care or holistic care for treating chronic pain, while men were more likely to endorse research into physical activity or exercise for chronic pain. Individuals with higher income were less likely to endorse research into chiropractic or physiotherapy for chronic pain. These findings will help guide research funders and investigators to optimize alignment between empirical studies and the needs of veterans living with chronic pain.