USASP
US ASSOCIATION FOR THE STUDY OF PAIN

PUBLISHED BY
ELSEVIER

The Journal of Pain, Vol 24, No 2 (February), 2023: pp 273–281
Available online at www.jpain.org and www.sciencedirect.com

Mental Health Diagnoses are Not Associated With Indicators of Lower Quality Pain Care in Electronic Health Records of a National Sample of Veterans Treated in Veterans Health Administration Primary Care Settings

Steven K. Dobscha,[†,‡] Stephen L. Luther,[§,¶] Robert D. Kerns,[‖,**] Dezon K. Finch,[§] Joseph L. Goulet,[‖,††] Cynthia A. Brandt,[‖,††] Melissa Skanderson,[‖] Harini Bathulapalli,[‖] Samah J. Fodeh,[‖,††] Bridget Hahm,[§] Lina Bouayad,[§,‡‡] Allison Lee,[‖,**] and Ling Han[‖,§§]

[†]*Department of Psychiatry, Oregon Health & Science University, Portland, Oregon,* [‡]*VA Portland Health Care System, Center to Improve Veteran Involvement in Care (CIVIC), Portland, Oregon,* [§]*Research Service, James A. Haley Veterans Hospital, Tampa, Florida,* [¶]*College of Public Health, University of South Florida, Tampa, Florida,* [‖]*VA Connecticut Healthcare System, Pain Research, Informatics, Multi-morbidities and Education (PRIME) Center, West Haven, Connecticut,* [**]*Yale School of Medicine Department of Psychiatry and Neurology, New Haven, Connecticut,* [††]*Yale School of Medicine Department of Emergency Medicine, New Haven, Connecticut,* [‡‡]*Information Systems and Business Analytics, College of Business, Florida International University, Miami, Florida,* [§§]*Yale School of Medicine Department of Internal Medicine, New Haven, Connecticut*

Abstract: **Prior research has demonstrated disparities in general medical care for patients with mental health conditions, but little is known about disparities in pain care. The objective of this retrospective cohort study was to determine whether mental health conditions are associated with indicators of pain care quality (PCQ) as documented by primary care clinicians in the Veterans Health Administration (VHA). We used natural language processing to analyze electronic health record data from a national sample of Veterans with moderate to severe musculoskeletal pain during primary care visits in the Fiscal Year 2017. Twelve PCQ indicators were annotated from clinician progress notes as present or absent; PCQ score was defined as the sum of these indicators. Generalized estimating equation Poisson models examined associations among mental health diagnosis categories and PCQ scores. The overall mean PCQ score across 135,408 person-visits was 8.4 (SD = 2.3). In the final adjusted model, post-traumatic stress disorder was associated with higher PCQ scores (RR = 1.006, 95%CI 1.002–1.010, *P* = .007). Depression, alcohol use disorder, other substance use disorder, schizophrenia, and bipolar disorder diagnoses were not associated with PCQ scores. Overall, results suggest that in this patient population, presence of a mental health condition is not associated with lower quality pain care.**

Perspective: ***This study used a natural language processing approach to analyze medical records to determine whether mental health conditions are associated with indicators of pain care quality as documented by primary care clinicians. Findings suggest that presence of a diagnosed mental health***

Received March 10, 2022; Revised July 8, 2022; Accepted August 25, 2022.

This work was funded by NIH/NCCIH and VA HSR&D Grant Pain Care Quality and Integrated and Complementary Health Approaches (R01 AT008448/IIR 14-438; Brandt, Kerns, Luther PI's), VHA HSR&D Musculoskeletal Diagnoses Cohort: Examining Pain and Pain Care in the VA (CRE 12-012; Goulet, Brandt PI's). Dr. Han is supported in part by the Claude D. Pepper Older Americans Independence Center at Yale University School of Medicine (#P30AG021342 NIH/NIA), and VA HSR&D Service Pain Research, Informatics, Multimorbidities and Education (PRIME) Center of Innovation (CIN 13-047). The opinions expressed here are those of the authors and do not represent the official policy or position of the US Department of Veterans Affairs.

The authors have no conflict of interests to declare.

Address reprint requests to Steven K. Dobscha, MD, VA Portland Health Care System, 3710 SW US Veterans Hospital Road, R&D 66, Portland, OR, 97239. E-mail: steven.dobscha@va.gov

1526-5900/$36.00

https://doi.org/10.1016/j.jpain.2022.08.009

condition is not associated with lower quality pain care.

Keywords: *Pain care, Mental health, Musculoskeletal pain, Veterans Health Administration (VHA).*

Chronic pain affects approximately 20% of U.S. adults,[6] and its prevalence may be increasing.[17] An Institute of Medicine report in 2011 estimated the total annual incremental cost of health care due to pain in the United States at $261−$300 billion.[20] Musculoskeletal pain is the most prevalent chronic pain syndrome and one of the most common causes of disability.[4] Veterans have a higher prevalence of chronic pain than civilians;[1] prior estimates suggest that up to half of Veterans treated in VHA ambulatory settings have chronic pain.[21]

Pain conditions frequently co-occur with multiple medical comorbidities and mental health and substance use disorders, which further worsen clinical outcomes, participation in relationships, activities of daily living, and other functional outcomes.[15] Mental health conditions are especially common among individuals with chronic pain and have been associated with worse outcomes.[3] Depression may be the most common co-occurring mental health condition among individuals with chronic pain, with prevalence estimates ranging from one-third to over half depending on the treatment setting.[3] Mechanisms by which mental health conditions may worsen pain outcomes include direct (and perhaps synergistic) effects of each condition on shared functional outcomes, shared bidirectional psychological mechanisms such as catastrophizing and emotion regulation and shared neural mechanisms.[18,23]

An additional but understudied potential mechanism that may contribute to worse pain outcomes among individuals with co-occurring mental health conditions is a disparity in access to or receipt of high-quality pain care. While modifiable risk behaviors contribute to much of the morbidity and early mortality related to severe mental illness,[12] potential contributors may also include limitations in patient access to high-quality care,[22,27] challenges with patient adherence, and competing demands on clinicians to address often multiple and complex conditions.[35] We know little about how co-occurring mental health conditions may specifically impact access to or receipt of high-quality *pain* care. There is some evidence to support that only a minority of patients with chronic pain and substance use disorders (SUD) receive multifaceted, guideline-concordant *pain* care,[29] and may be less likely to follow through with pain treatment recommendations compared to other patient populations.[13]

Clinical practice guidelines recommend that clinicians treating pain 1) conduct a timely and comprehensive pain assessment; 2) develop and enact a pain treatment plan; and 3) reassess symptoms and the effectiveness of treatment.[8,36] Recently, a reliable method using natural language processing (NLP) for extracting information from VHA electronic health records to assess key dimensions of pain care quality was developed.[25] Development of this approach extended earlier work that used manual medical record review for assessing the quality of pain care documented by VHA primary care clinicians.[5,10] The purpose of the study reported here was to utilize this NLP approach to determine to what extent mental health condition diagnoses are associated with indicators of pain care quality as documented by VHA clinicians. Based on prior work suggesting potential for disparities due to mental health conditions, we hypothesized that mental health conditions would be negatively associated with total Pain Care Quality (PCQ) scores.

Methods

Methods for defining the sample and extracting and coding from records have been previously described.[26] The study was approved by the VA Connecticut Healthcare System, Yale University, and the University of South Florida Institutional Review Boards.

Data Source and Study Population

Data from VHA's national corporate data warehouse (CDW) were linked to the Musculoskeletal disease (MSD) cohort.[13] The national MSD Cohort was created to characterize variation in pain, comorbidities, treatment, and outcomes among patients with MSD receiving VHA care. To be included in the cohort, a Veteran had to have 2 or more outpatient visits with an MSD diagnosis documented in visit encounters occurring within 18 months of each other, or 1 or more inpatient stays with an MSD diagnosis.[13] Based upon previous work,[10] using an MSD Cohort from Fiscal Year (FY) 2013, NLP algorithms were developed to extract indicators from text notes of pain care quality (PCQ). To support development, a sample of approximately 2,500 documents was selected in 2 waves. In the first wave, all documents from primary care visits in FY 2013 were selected for 176 patients to examine documentation for initial assessment of pain (eg, pain site, diagnosis, impact on function) and pain reassessment. The second wave of development focused more on identification of treatments or clinician actions informed by assessments (eg, patient education, medications, referrals). Sampled notes were independently annotated by 2 clinicians. Initial inter-rater reliabilities ranged from .60 to .80 between the annotators, and disagreements were adjudicated by a third expert to develop a reference set of documents for NLP algorithms. Specific descriptions of types of treatments included in the original manual record review studies[5,10] were not included in the final NLP system. For example, pain-related medication use was in the plan of care and therefore almost universal in the sample, which limited variability and added no value to the overall PCQ measure. Further, the team was

Table 1. Pain Care Quality Indicator (PCQ) Measures

Pain Care Quality Indicator	*Examples of Text Used for NLP Development*
Pain Assessment	
Pain	Aches and pains; are you having any pain?; due to pain; flares of pain; not satisfied with pain level; pain episodes; patients pain goal is; reports pain
Site in Body	Back of knees; bilat foot; central low back; C3-4; generalized joint; hip bursae; muscular neck; T spine; upper thigh
Intensity	Mild; moderate; is problematic; severe; no more than 4
Etiology/Source	Bony stenosis; bulging discs; cervical pathology; djd lower leg/knee; fibromyalgia; osteoarthritic changes; tear in lateral meniscus
Physical diagnostics (exam)	Able to feel touch; able to walk on heels and toes; Babinski normal; chronic joint deformities; decreased lumbar rom; flexed at the hip causes pain; knee—tender to palpation
Persistence	6 months or more; acute; almost every day; breakthrough; chronic; over 10 years; periodic; persistent
Sensation	Shooting needles; stabbing; radiating down; dull ache; numbness
Aggravators or Alleviators	Very slight movement; getting out of bed; if kneeling; in cold; pain improves as patient gets out of bed; quiet dark room; warm shower
Impact on function	Difficulty ambulating; discomfort when standing; hard to live a normal life; limited ROM; sleep disturbance
Plan of Care	
Referral	E-consult placed; needs to see a . . .; refer the patient to. . .; discuss pain treatment with. . .
Education/Self-management	Medication treatment agreement; pain education/support group; patient verbalized understanding; cold applications; daily stretching; doing lighter work; heat or ice treatment
Reassessment	
Reassessment	Pain improves with acupuncture, Increased dose of gabapentin for pain

cognizant that more care is not necessarily higher quality care. Instead, clinical actions assessed reflected referrals for specialty or ancillary pain treatment (reflecting multidisciplinary approaches), pain education, and self-management.

Rule-based NLP extraction algorithms were constructed in Python based on the targeted quality indicators. A rule-based method was well suited to this task as most concepts were based on named entities or were easily broken down into component parts for writing rules. The results were compared with the human-annotated data and found to be reliable (overall F-measure, 0.92).[26] A list of 12 binary (presence vs absence) PCQ indicators was established, which included nine items related to *Assessment of Pain*, 2 items related to the *Pain Care Plan*, and one item for *Reassessment*. (Table 1). PCQ scores range from 1 to 12, with each item weighted equally. Three of the PCQ indicators (pain, etiology/source, and site in the body) were documented in greater than 90% of visits, while 4 of the PCQ indicators (persistence, sensation, what makes the pain better or worse and pain's impact of function), were documented in fewer than half of visits. Standardized Cronbach's alpha for the PCQ indicators was 0.74.[26]

The NLP algorithm was more recently applied to all notes generated from 63,427 Veterans and a total of 146,507 clinical visits from FY2017. Comparison of the characteristics and pain quality indicators from the FY2017 and FY2013 cohorts suggested that the NLP approach was stable over time.[26] An index date was defined as the date of the first MSD diagnoses that conferred cohort inclusion. After excluding Veterans with index dates before FY2017 and removing multiple patient care visits occurring on the same date, we identified 62,721 Veterans with 134,508 person-visits for the current analysis who had clinically significant pain (Numeric Rating Scale[14] pain intensity rating ≥ 4) during one or more outpatient visits at a facility where the MSD-qualifying diagnosis was made during FY2017 (October 2017 through September 2018) (Fig 1).

For the current analysis, we used a summary score of the 12 indicators as the primary outcome (PCQ score); indicators were given equal weight. The primary exposure, major mental health diagnosis categories, included depressive disorders (other than bipolar disorder), bipolar disorder, post-traumatic stress disorder (PTSD), schizophrenia/schizophreniform disorder, alcohol use disorders (AUD), and substance use disorder other than AUD (SUD). The sensitivity of diagnostic codes for anxiety as indicators for treatment of conditions such as depression used in primary care has been shown to be low, and sensitivity can be lower for patients with comorbid conditions[37]; thus we did not include anxiety as a major mental health diagnosis category.

Data on demographic and military characteristics were obtained from the CDW and included age, gender, race/ethnicity, marital status, service in Iraq and Afghanistan, body mass index (BMI), and current smoking status. MSD or other pain conditions were represented by 11 individual diagnostic categories, including back pain, neck pain, low back pain, fibromyalgia, fracture, osteoporosis, nontraumatic joint damages, sprains/strains, gout, traumatic joint/muscle/spinal cord injuries, rheumatic-osteoarthritis[16] (International Classification of Diseases 10th revision—Clinical Modification [ICD-

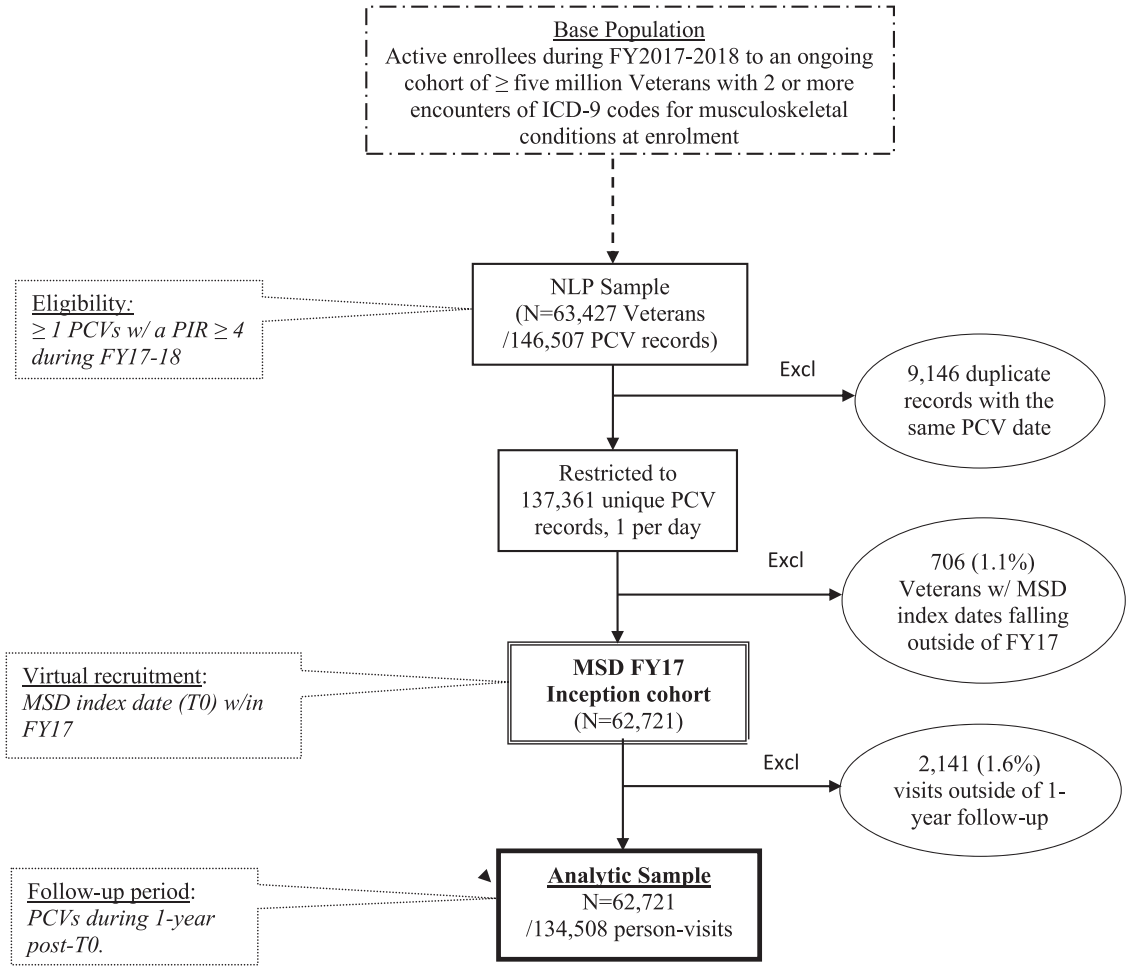

Figure 1. A Flowchart of Cohort Assembly
Abbreviations: FY, Fiscal Year; NLP, Natural Language Processing; PCV, Patient Care Visit; PIR, Pain Intensity Rating based on Numeric Rating Scale (NRS); MSD, Musculoskeletal Disease.

10CM] codes used in the analyses are available from the authors on request). Co-occurring conditions were identified within 1 year before and 6 months after the index MSD date. General medical conditions included diabetes, hypertension, coronary artery disease, chronic heart failure, cancer, chronic pulmonary diseases, other cardiovascular diseases, peripheral vascular diseases, and renal diseases. Visit attendance was determined using encounter and stop codes available in the CDW. We also collected data on opioid prescription status (yes/no; excluding tramadol and methadone), NRS score, Veterans Integrated Service Network (VISN) region and VHA facility complexity level[7] based on the primary station where Veterans received usual care or their index MSD diagnosis.

Statistical Analyses

Baseline characteristics of Veterans are presented as frequency (percentages) and means (± standard deviations or median (Intra-Quartile Range). We used generalized estimating equations (GEE) to examine the longitudinal association between each of the mental health diagnosis categories listed above and PCQ outcome over the 12-month follow-up period.[20] In the primary analyses, we used the composite PCQ total score across all 12 indicators at each visit as a time-dependent Poisson count outcome, whose values can change from one visit to the next. The derived parameter estimate from the model was the exponentiated to rate ratio (RR), which represents the average proportional increment (or decrement) on the PCQ score between individuals who have a mental health category diagnosis (vs individuals who do not have the diagnoses in that category). The 95% Confidence Interval of RR was obtained using a robust variance estimator. Within-subject correlations among repeated individual PCQ indicator assessments over serial visits were accounted for using a first-order autoregressive covariance structure.

We fit GEE Poisson models in a hierarchical fashion. First, we examined a *baseline* model in the full cohort for each of the 7 mental health diagnosis categories (models 1a−1f). Next, we simultaneously included all the diagnosis categories in a single model (Model 2). Finally, in Model 3, we added *a priori* selected person-specific risk factors that may confound association between mental health diagnoses and pain care quality. These covariates included age, sex, race/ethnicity,

service era, smoking status, obesity, MSD diagnoses, additional general medical conditions, opioid prescription status (yes/no), duration of VHA care prior to study entry, baseline pain intensity rating ≥4 (yes/no), calendar year of index MSD diagnosis, VISN region, and VHA facility complexity level. Rates of covariate missingness were low (marital status 3.0%; smoking 4.7%, obesity 2.6%). To minimize impact of missing data on model estimation and sample size, a separate missing-data category was assigned in addition to the index and reference categories for these covariates in the analyses.

We also performed several sensitivity analyses to evaluate the robustness of primary findings. First, we redefined the PCQ count outcome based on only the nine pain *assessment* indicators (Mean ± SD: 5.9 ± 1.8) and refit the fully adjusted GEE Poisson model. In another sensitivity analysis, we examined the relationship between total number of mental health diagnosis categories (as an indicator of mental health condition burden) and total PCQ score.

All statistical analyses were conducted using SAS software version 9.4 (SAS Institute, Cary NC 2012). Model fit was examined using Quasi-Information Criterion and residual plots. The hypotheses were tested at a 2-sided significance level of $\alpha = .05$.

Results

In this cohort of Veterans with chronic pain (Table 2), the average pain score was 5.7 (sd = 2.6), and 36% had one or more comorbid mental health conditions; the most common mental health condition was depression, followed by PTSD. Low back pain was the most common source of pain and comorbid chronic medical conditions were common. Veterans with mental health diagnoses were younger (average age 49.1 vs 53.0, $P <$. 001), more likely to be female (17.4% vs 11.1%, $P < .001$), less likely to be white, non-Hispanic (55.5% vs 60.2%, $P < .001$), less likely to be married (47.5% vs 52.1%, $P < .001$), more likely to have served in recent military conflicts (66.0% vs 48.8%, $P < .001$), and more likely to smoke (44.9% vs 32.8%, $P < .001$).

The mean PCQ score across 134,508 person-visits was 8.4 (SD: 2.3). Table 3 shows the models describing relationships between each of the 6 mental health diagnosis categories and PCQ scores. In the first model, the relationship between each of the mental health diagnosis categories and PCQ score by itself without inclusion of covariates is shown. Model 2 simultaneously includes all diagnosis categories, and Model 3 (final model) is adjusted for patient characteristics, temporal, and spatial confounding, and within-person correlations among multiple visits over time. In the final model, post-traumatic stress disorder (PTSD) was associated with higher PCQ scores (RR = 1.006, 95%CI 1.002−1.010, $P = .007$). Depression, alcohol use disorder, other substance use disorder, schizophrenia, and bipolar disorder diagnoses were not associated with PCQ score. Examining the covariates in the final model, married Veterans (RR = 1.004, 95%CI 1.001−1.007, $P = .018$) and Veterans with higher pain scores (NRS ≥4) at the cohort index date (R = 1.019, 95%CI 1.014−1.024, $P < .0001$) had higher PCQ scores. Hispanic ethnicity (RR = .992, 95%CI .986−.997, $P = .004$) and cancer diagnosis (R = .991, 95%CI .984−.999, $P = .023$) at the index date were associated with slightly lower PCQ scores; other race/ethnicity and co-occurring medical condition diagnosis variables were not significantly associated with PCQ score.

In the first sensitivity analysis, we redefined the PCQ count outcome based solely on the 9 pain *assessment* indicators (average PCQ-9 score = 5.9; SD-1.8) and refit the fully adjusted GEE Poisson model. Results were very similar to the original model. In a second sensitivity analysis, in the fully adjusted model, we examined the relationship between total number of mental health diagnosis categories (an indicator of burden, range: 0−6) and total PCQ score; there was also no significant relationship (RR = 1.000, 95%CI: 0.998−1.001, $P = .636$).

Discussion

To date, very little has been published regarding disparities in pain care quality among patients with co-occurring mental health conditions. In our analysis of this large national cohort, we found that Veterans with PTSD had slightly, but significantly higher PCQ scores compared to patients without these diagnoses. Other mental health diagnosis categories were not significantly associated with differences in PCQ scores. We also found no relationship between an overall measure of mental health condition burden and PCQ score. Across other potential predictor variables we examined, the factor most strongly associated with PCQ score was pain intensity; we would expect higher pain intensity scores to be associated with higher PCQ scores as patients and providers are more likely to focus on addressing pain in the context of greater pain intensity levels.

It is encouraging that the findings from this study suggest that pain care quality is not compromised by the presence of co-occurring depression, PTSD, alcohol use disorder, other substance use disorder, or schizophrenia and bipolar disorder; many of these conditions are common among individuals with chronic pain. However, there is a solid evidence base supporting that patients with co-occurring mental health conditions have worse medical outcomes in general, which can reflect challenges accessing high-quality care.[11,22,27] We note that over the past few decades, considerable efforts have been made within VHA and other healthcare institutions to educate primary care clinicians about common co-occurring mental health conditions, in particular, the relationship between pain and depression. Further, the VHA is a capitated and largely integrated system; barriers to general medical care that individuals with chronic mental health conditions may be fewer than those faced in the public sector.

Unfortunately, there are few other studies available for direct comparison. We identified few studies in which access to pain care or indicators of pain care quality served as outcomes. In an analysis of Canadian Drug

Table 2. Characteristics of the Patient Cohort, Comparing Individuals with Mental Health Diagnoses to Those Without

Characteristics by Domain	*OverallN (%) N = 62,721*	*Has Mental Health Diagnosis* N = 22,756 (36.3)*	*Does not have Mental Health Diagnosis N = 39,965 (63.7)*	P *Value*
	Demographic, military & behavioral			
Age (yr)	50.5 ± 16.6	49.1 ± 14.9	53.0 ± 17.0	<.001
Female	8406 (13.4)	3954 (17.4)	4452 (11.1)	<.001
Race/ethnicity	36706 (58.5)	12634 (55.5)	24072 (60.2)	<.001
White, non-Hispanic	15000 (23.9)	5810 (25.5)	9190 (23.0)	
Black, non-Hispanic	5803 (9.3)	2388 (10.5)	3415 (8.5)	
Hispanic (any)	5212 (8.3)	1924 (8.5)	3288 (8.2)	
Other or unknown				
Currently married	31652 (50.5)	10819 (47.5)	20833 (52.1)	<.001
Current smoker	23326 (37.2)	10207 (44.9)	13119 (32.8)	<.001
Body Mass Index (BMI)	30.4 ± 6.1	30.1 ± 6.0	30.5 ± 6.1	<.001
Service during recent military conflicts	34501 (55.0)	15010 (66.0%)	19491 (48.8%)	<.001
	Mental Health Conditions			
PTSD	11779 (18.8)	11779 (58.8)	–	–
Alcohol Use Disorder	4985 (8.0)	4985 (21.9)	–	–
Drug Use Disorder	2821 (4.5)	2821 (12.4)	–	–
Bipolar Disorder	1351 (2.2)	1351 (5.9)	–	–
Depression	13,599 (21.7)	13,599 (59.8)	–	–
Schizophrenia	524 (0.8)	524 (2.3)	–	–
	Musculoskeletal Diseases (MSDs) and other pain conditions			
Back pain	1923 (3.1)	785 (3.5)	1138 (2.9)	<.001
Neck pain	6008 (9.6)	2393 (10.5)	3615 (9.1)	<.001
Low back pain	24659 (39.3)	9517 (41.8)	15142 (37.9)	<.001
Fibromyalgia	870 (1.4)	447 (2.0%)	423 (1.1)	<.001
Fracture	1217 (1.9)	468 (2.1)	749 (1.9)	.111
Osteoporosis	140 (0.2)	52 (0.2)	88 (0.2)	.832
Nontraumatic joint damage	24231 (38.6)	8456 (37.6)	15685 (39.3)	<.001
Sprains/strains	1091 (1.7)	381 (1.7)	710 (1.8)	.346
Gout	1541 (2.5)	385 (1.7)	1156 (2.9)	<.001
Traumatic joint/muscle/spinal cord injuries	997 (1.6)	605 (1.5)	392 (1.7)	.044
Rheumatic-/osteoarthritis	4742 (7.6)	1341 (5.9)	3401 (8.5)	<.001
Other pain conditions	10043 (16.0)	3798 (16.7)	6245 (15.6)	<.001
	Other clinical conditions			
Obesity	29,278 (46.7)	10415 (45.8)	18863 (47.2)	<.001
Diabetes	11431 (18.2)	3311 (14.6)	8120 (20.3)	<.001
Hypertension	21182 (33.8)	12723 (43.3)	17239 (49.2)	<.001
Coronary artery disease	959 (1.5%)	2717 (9.3%)	4292 (12.2%)	<.001
Chronic heart failure	2249 (3.6)	756 (3.3)	1493 (3.7)	.007
Cardiovascular diseases	2269 (3.6)	830 (3.7)	1439 (3.6)	.763
Peripheral vascular diseases	2946 (4.7)	2077 (5.2)	869 (3.8)	<.001
Chronic pulmonary diseases	7394 (11.8)	2893 (12.7)	4501 (11.3)	<.001
Renal diseases	2933 (4.7)	2093 (5.2)	840 (3.7)	<.001
Cancer	3005 (4.8)	890 (3.9)	2116 (5.3)	<.001
Inpatient care at time of cohort entry	1900 (3.0)	1186 (5.2)	714 (1.8)	<.001
Prescription opioids†	2951 (4.7)	970 (4.3	1981 (5.0)	<.001
Moderate to severe pain‡	47030 (45.0)	16636 (73.1)	30394 (76.1)	<.001
	Temporal/spatial covariates			
Duration of VHA enrollment (mos), mean±SD	73.7 ± 64.1	71.8±62.7	74.8 ± 64.8	<.001
Index MSD diagnosis in 2016	21381 (34.1)	8045 (35.4)	13336 (33.4)	<.001
Index MSD diagnosis in 2017	41340 (65.9)	14711 (64.7)	26629 (65.6)	
Facility complexity§ *1a*	29822 (47.6)	11199 (49.2)	18636 (46.6)	<.001
Facility complexity§ *1b*	13900 (22.2)	4769 (21.0)	9131 (22.9)	
Facility complexity§ *1c*	10874 (17.3)	3951 (17.4)	6923 (17.3)	
Facility complexity§ *2*	3953 (6.3)	1360 (6.0)	2593 (6.5)	
Facility complexity§ *3*	4159 (6.6)	1477 (6.5)	2682 (6.7)	

Abbreviations: MSD, Musculoskeletal Disorders; ADRD, Alzheimer's Diseases and Related Dementia; VISN, VA Information System Network.
*Subject has one or more mental health diagnoses that fall into the 6 mental health diagnosis categories.
†Active opioid prescriptions exclusive of tramadol and methadone within one month of index date.
‡Moderate to severe pain was defined as NRS pain intensity rating ≥4
§Complexity levels ranged from most complex (*1a*) to least complex (*3*) based on primary facility where Veterans received their usual health care and/or index musculoskeletal diagnosis.

Table 3. GEE Models of PCQ Score Among 62,721 US Veterans With Moderate to Severe Chronic Pain

Model	Diagnosis Category	RR*	Lower Limit 95% CI	Upper Limit 95% CI	P Value
Model 1					
1a	PTSD	1.004	1.001	1.008	.022
1b	Depression	0.992	0.985	0.999	.021
1c	AUD	0.999	0.995	1.003	.551
1d	SUD	0.993	0.988	0.999	.015
1e	Schizophrenia	0.998	0.987	1.008	.636
1f	Bipolar disorder	0.984	0.969	1.000	.045
Model 2					
	PTSD	1.006	1.002	1.010	.004
	Depression	0.999	0.995	1.002	.489
	AUD	0.994	0.988	1.000	.057
	SUD	0.995	0.987	1.002	.168
	Schizophrenia	0.986	0.971	1.002	.083
	Bipolar disorder	1.000	0.989	1.010	.927
Model 3					
	PTSD	1.006	1.002	1.010	.007
	Depression	0.997	0.994	1.001	.148
	AUD	0.996	0.989	1.002	.148
	SUD	0.998	0.990	1.006	.598
	Schizophrenia	0.996	0.981	1.011	.585
	Bipolar disorder	1.000	0.990	1.010	.955

Abbreviations: AUD, Alcohol use disorder; CI, Confidence Interval; PTSD, Post-traumatic stress disorder; RR, Rate (or count) Ratio; SUD, Substance Use Disorder other than alcohol use disorder.
Models 1a – 1f included only the specific diagnosis category as a predictor.
Model 2 simultaneously included all 6 diagnosis categories as binary indicators (presence vs absence)
Model 3 adjusted for age, sex, race, marital status, serviced in OES/OIS/POS, current smoker, obesity, individual MSD dx (back pain, neck pain, low back pain, non-traumatic, joint damages, arthritis, fibromyalgia, fracture, osteoporosis, gout, sprain-strain and traumatic joint/muscle damages), individual medical conditions (diabetes, hypertension, coronary artery diseases, chronic heart failure, cancer, chronic pulmonary diseases, cardiovascular diseases, peripheral vascular diseases and renal diseases), inpatient care, opioid use, history of VHA enrollment, NRS≥4 at baseline, calendar year of study entry, Facility Complexity level and VISN.
*RR was estimated using a Poisson model with robust variance estimator and represents the proportional difference in the PCQ score between Veterans with each specific diagnosis category versus those without.

Benefit data, Redelmeier and colleagues[31] found that among older individuals with several index chronic conditions, unrelated conditions were often undertreated; in this observational study, patients with psychotic disorders were 41% less likely to receive medical treatment for arthritis compared to other patients. Morasco and colleagues[29] found that patients with both chronic noncancer pain and SUD were more likely to receive pharmacotherapy for pain and to have mental health appointments, but were not more or less likely to participate in other aspects of pain care compared to individuals without SUD. Other studies have shown that individuals with SUD and chronic pain are less satisfied with pain treatment,[2] less likely to follow through with ancillary pain treatment recommendations and referrals,[13] and more likely to misuse or divert prescribed opioid medication,[30] all potential barriers to receipt of high-quality pain care.

Several possibilities may help to explain our finding that individuals with PTSD had slightly greater PCQ scores. While there is limited information available regarding treatment adherence in patients with PTSD, multiple studies suggest that overall, PTSD is associated with an increased likelihood of missed appointments and underuse of medications for medical conditions.[34] However, PTSD and chronic pain have also been shown to share neural mechanisms,[28] and common pathways and vulnerabilities including anxiety sensitivity[1] and catastrophizing,[33] may contribute to mutual maintenance of both sets of symptoms.[24,33] As such, it is possible individuals with PTSD may be more likely to bring up or discuss pain with their providers. It is also possible that Veterans with PTSD may be more assertive or activated in pursuing pain treatment options. Indeed, in one recent study of use of VHA's electronic healthcare portal (VHA OpenNotes), Veterans with PTSD were twice as likely to read their progress notes online compared to Veterans with other mental health conditions.[9] Patients with PTSD are also more likely to be prescribed medications used for pain including opioids[32] and antidepressants; this may create more opportunities for communications with providers about pain.

Several imitations to this study are worth noting. Our methodology does not allow us to determine the extent to which our findings are associated with clinical outcomes, nor are clinically meaningful, even though we found statistically significant differences. The analysis is based on documentation of care in the note and may not fully reflect the quality of care provided. The PCQ score likely represents an ordinal level, not an interval level, of measurement with higher scores representing greater PCQ; PCQ individual items were each assigned the same weight, which has not been validated against pain outcomes nor reflects patient preferences. We

note, however, that the sensitivity analysis using an alternative scoring PCQ scoring method yielded similar findings. The PCQ score was derived from the VHA electronic health record among a population of Veterans; the results may not generalize to other patient populations. The MSD only includes Veterans who had an MSD recognized by their providers. Veterans often seek care outside of the VHA; documentation of such care was not able to be captured. Inaccuracies can result from reliance on electronic health record-derived diagnoses rather than structured interviews, and some mental health conditions are under-coded in primary care settings.[37] Use of smaller and older samples for initial development of the NLP models may have introduced bias.[19] It is possible that PCQ is not sensitive or broad enough to detect important components of pain care. While the use of NLP to examine care quality across a broad patient population is innovative, additional NLP work and analysis is needed to learn more its benefits and limitations.

Conclusion

In this study, we found that Veterans treated in primary care with PTSD diagnoses had slightly higher PCQ scores compared to Veterans without these diagnoses. Perhaps more importantly, the results suggest that in this cohort treated within the VHA, presence of a mental health condition is not associated with worse pain care. Nonetheless, in many care systems, patients face multiple barriers to care. Such barriers can include lack of parity in coverage, carve-outs of mental health coverage that can disincentivize treatment-seeking, lack of integration of primary care with mental health services, and educational deficits or lack of support for clinicians. As such, efforts should continue to be made to educate clinicians about the need for pain care, and how to approach, assess and provide pain treatment in populations with mental health conditions, especially when patients present with complex or competing medical problems, or have challenges communicating their needs.

Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jpain.2022.08.009.

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