

Opioid and Nonpharmacologic Treatments Among Soldiers With Chronic Pain and Posttraumatic Stress Disorder

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Objective: This study examined the prevalence of chronic pain alone, posttraumatic stress disorder (PTSD) alone, and both chronic pain and PTSD among U.S. Army soldiers during the postdeployment year.

Methods: The sample was 576,425 active duty soldiers returning from deployment in Afghanistan or Iraq between October 1, 2008, and September 30, 2014. Bivariate statistics were used to compare health care utilization among subgroups. Multivariate logistic regression with additional covariates was used to identify predictors of receiving an opioid days' supply of >30 days in the postdeployment year among soldiers with chronic pain, focusing on the effect of PTSD alone and on an interaction of PTSD with nonpharmacologic treatments (including therapeutic exercise, chiropractic treatment, acupuncture, and biofeedback).

Results: In total, 12.2% of the soldiers received a chronic pain diagnosis, 5.1% a PTSD diagnosis, and 1.8% had both. Among

soldiers with both conditions, 80.3% received nonpharmacologic treatment, and 31.4% received an opioid days' supply of >30 days. Among soldiers with chronic pain, comorbid PTSD and lack of nonpharmacologic treatment was associated with increased odds of receiving an opioid days' supply of >30 days (odds ratio [OR]=1.4, 95% confidence interval [CI]=1.3–1.6). PTSD combined with specific nonpharmacologic treatment modalities had a variable relationship with opioid receipt, and only PTSD with acupuncture or biofeedback was associated with reduced odds (OR=0.8, 95% CI=0.7–0.9).

Conclusions: Soldiers having both chronic pain and PTSD have significant health care needs. Although these soldiers accessed mental health care and received nonpharmacologic treatment, additional interventions are needed to mitigate protracted opioid utilization.

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Both posttraumatic stress disorder (PTSD) (1) and chronic pain (2) are prevalent and highly comorbid in the U.S. population. A nationally representative U.S. study indicated that, compared with individuals without PTSD, those with PTSD have a higher prevalence of musculoskeletal, digestive, and nerve pain conditions (3). For active duty and veteran populations, these comorbid conditions are especially noteworthy. Rates of chronic pain are higher among active duty service members and veterans than among their civilian counterparts (4), and chronic pain and PTSD often co-occur after combat deployment (5–9). Compared with the prevalence of PTSD in civilian populations with chronic pain, PTSD prevalence among veterans with chronic pain may be as high as 50% (10). Much of the literature examining the presence of and treatment for comorbid chronic pain and PTSD comes largely from studies of veterans, although the co-occurrence of both conditions is relevant across both civilian and military settings.

Comorbid chronic pain and PTSD may be associated with worse outcomes and reduced quality of life, relative to

chronic pain or PTSD alone. Compared with veterans with chronic pain only, those with comorbid chronic pain and

HIGHLIGHTS

- In the postdeployment year, posttraumatic stress disorder (PTSD) was three times more common among U.S. Army soldiers who had chronic pain than among soldiers without chronic pain.
- Receipt of opioids for >30 days in the postdeployment year was almost twice as likely for soldiers with both chronic pain and PTSD than for those who had chronic pain but not PTSD.
- Eighty percent of soldiers with chronic pain and PTSD received nonpharmacologic treatment, most commonly therapeutic exercise.
- Ninety-nine percent of soldiers with a PTSD diagnosis were seen by a mental health provider.

PTSD symptoms reported higher pain intensity and higher levels of pain-related disability (6). Among veterans of the Afghanistan or Iraq conflicts who received care in the Veterans Health Administration (VHA) system and received an opioid prescription, those who also had a PTSD diagnosis were more likely to receive opioids for pain diagnoses, higher-dose opioids, two or more concurrent opioids, concurrent hypnotic prescriptions, and early opioid refills, compared with those without PTSD and those with other mental health conditions (11). These findings are mirrored by those with a nationally representative U.S. civilian sample, in which comorbidity of chronic pain and PTSD was associated with a greater risk for opioid use disorder (3).

Mental disorders among veterans, including PTSD, are associated with increased behavioral health and nonbehavioral health care utilization (12–14), yet few studies have focused on populations with comorbid chronic pain (15, 16). In a study of veterans treated in the VHA system in 2002–2007, those with comorbid pain and PTSD had 7% more primary care visits and 25% more pain specialty visits than the group with chronic pain only and 46% more primary care visits than the group with PTSD only (17). Only about 50% of eligible veterans utilize VHA health care services after leaving the military (18, 19); thus, examining health care utilization patterns of military members in the Military Health System (MHS) provides a more complete picture of treatment received among individuals with comorbid chronic pain and PTSD.

The MHS has taken steps to address both chronic pain and PTSD with a patient-centered approach (20). This approach includes establishing interdisciplinary and integrative pain management approaches (21, 22) and promoting clinical practice guidelines for delivering high-quality mental health services for military members with PTSD (23, 24). These models often incorporate nonpharmacologic treatments for pain treatment and comorbid conditions (25, 26). The goal of this study was to examine the prevalence of chronic pain alone, PTSD alone, and chronic pain together with PTSD among U.S. Army soldiers during the postdeployment year. For these three clinical subgroups, we examined receipt of nonpharmacologic treatment (such as therapeutic exercise and chiropractic treatment), prescription opioids, and other health care services. Last, because opioid prescriptions increase the risk for adverse outcomes (27, 28), we examined the association of PTSD with receipt of an opioid days' supply of >30 days during the postdeployment year among members in the chronic pain subgroup.

METHODS

Data Sources

Data from 576,425 Army active duty soldiers were extracted from the MHS Data Repository for the Substance Use and Psychological Injury Combat (SUPIC) study. In the SUPIC study, data were included for all soldiers returning from an Afghanistan or Iraq deployment in fiscal years 2008–2014.

Additional details on the methods for the SUPIC study are described by Larson and colleagues (29). Data from the SUPIC study include all pharmacologic treatments and outpatient and inpatient specialist and nonspecialist health care from all ambulatory claims and admissions in military “direct care” settings and civilian “purchased care” settings covered by TRICARE. Other data sources included pain scores from vital records of the Clinical Data Repository and deployment information from the Contingency Management System.

This study was approved by Brandeis University's Committee for Protection of Human Subjects; the Human Research Protection Program of the Office of the Assistant Secretary of Defense for Health Affairs/Defense Health Agency conducted the human subjects review. The Defense Health Agency's Privacy and Civil Liberties Office executed the data use agreements.

Sample Classification

The sample was classified by two characteristics observed during the postdeployment year: clinically significant chronic pain and receipt of a PTSD diagnosis. Clinically significant chronic pain was defined by duration of a pain diagnosis as the reason for care and duration of moderate or greater pain severity. Specifically, we required the presence of at least two ambulatory records with primary diagnoses of pain conditions, identified in our previous research of the same pain category (30) and spanning at least 90 days during the year, and self-reported pain scores of 4–10 (i.e., moderate to severe) on the numeric pain-rating scale for two or more encounters spanning at least 90 days (31). Soldiers classified as not having chronic pain may have received pain treatment but did not meet both the duration and pain intensity definitions. PTSD was based on the presence of the *ICD-9-CM* diagnosis code 309.81 in any position for any ambulatory or hospital care encounter. Our analysis required only one PTSD diagnosis, reflecting a concern that military providers are reluctant to record PTSD diagnoses (32, 33). In a sensitivity analysis, we used a more conservative PTSD definition, requiring one inpatient PTSD diagnosis, two outpatient PTSD diagnoses, or one PTSD diagnosis and a positive result for PTSD on the Primary Care PTSD Screen (34, 35) from the postdeployment health assessment or reassessment surveys (81% [N=23,721] of the PTSD sample [N=29,285], met this conservative definition).

Pharmacologic Treatments

To identify pharmacologic treatments for chronic pain, PTSD, or both, we analyzed records from the Department of Defense (DoD) Pharmacy Data Transaction Service, a comprehensive file that included all prescriptions dispensed to the soldiers in the sample. Each prescription record contained the days' supply, which we summed for the postdeployment year. We classified opioid prescription utilization during the postdeployment year as an opioid days' supply of ≥ 7 days or an opioid days' supply of >30 days. Our definition of opioid

prescriptions can be found in Adams et al. (36). Using the therapeutic classification of the American Hospital Formulary System, we selected other pharmacologic treatments for analysis, including tramadol (a weak opioid, scheduled as a controlled drug in 2014), other analgesics, selective serotonin reuptake inhibitors (SSRIs) or serotonin-norepinephrine reuptake inhibitors (SNRIs), benzodiazepines, and antipsychotics. We calculated the mean annual days' supply for each medication class.

Nonpharmacologic Treatments

Using procedure codes for ambulatory claims or encounters, we identified a set of nonpharmacologic treatment modalities that might be used for chronic pain or PTSD conditions, on the basis of our review of research and clinical guidelines studies (37–39). Nonpharmacologic treatments were organized into four large groups and were not mutually exclusive: therapeutic exercise, chiropractic and osteopathic spinal manipulation, complementary procedures (acupuncture, biofeedback, and cold laser), and other physical therapy procedures such as massage, heat, transcutaneous electrical nerve stimulation, traction, ultrasound, and lumbar supports. All nonpharmacologic treatments were assessed during the postdeployment year.

Other Health Care Utilization Measures

We included summary measures for any inpatient admission and the number of emergency department visits during the postdeployment year as descriptive measures of overall health status. We also used procedure codes to include measures of mental health specialty treatment and substance use specialty treatment.

Functional Measures

As a measure of functional ability, we also determined whether soldiers received any outpatient evaluation at a military treatment facility and had a documented duty limitation or work restriction for any reason, including assignment to quarters, restricted duty, or hospital admission.

Statistical Analysis

We present estimates of health care service receipt among soldiers within four subgroups: no chronic pain or PTSD, chronic pain only, PTSD only, and comorbid chronic pain and PTSD. Statistical comparisons of the percentage of soldiers with nonpharmacologic treatment utilization were made between the chronic pain groups (with and without PTSD) and between the PTSD groups (with and without chronic pain). For each medication class, we compared mean total days' supply among users. Chi-square tests were used for categorical measures and the test of means for continuous measures, with statistical significance set at $p < 0.001$.

We conducted logistic regression models on annual opioid days' supply of >30 days to assess the independent association of receiving a PTSD diagnosis, controlling for four nonpharmacologic treatment modalities. Because the dependent

variable was opioid receipt, we restricted this analysis to the chronic pain subgroup ($N=70,309$). To further investigate the potential role of PTSD as a moderator of nonpharmacologic treatments, interaction terms of PTSD status with each nonpharmacologic treatment modality were added to the regression model. Analyses controlled for age, sex, race or ethnicity, marital status, fiscal year of the end of the deployment, and military rank. Adjusted odds ratios with 95% confidence intervals and p values are reported. We conducted a sensitivity analysis by reestimating the logistic regression restricting our sample to soldiers who met the aforementioned conservative PTSD definition (i.e., the 81% of the PTSD subsample). The analyses were conducted with SAS software, version 9.4.

RESULTS

The SUPIC active duty cohort ($N=576,425$) was predominantly male (89.3%, $N=514,502$), White and non-Hispanic (57.1%, $N=328,910$), married (58.4%, $N=336,757$), and in the 18–24-year age range (40.7%, $N=234,431$). Of the cohort, 12.2% ($N=70,309$) met the definition for having clinically significant chronic pain during the postdeployment year, 5.1% ($N=29,285$) had a PTSD diagnosis, and 1.8% had both ($N=10,153$). Among soldiers with chronic pain, 14.4% ($N=10,153$) had a comorbid PTSD diagnosis, whereas among soldiers without chronic pain, only 3.8% ($N=19,132$) had a PTSD diagnosis. In all subgroups, the prevalence of a PTSD diagnosis was higher among soldiers with chronic pain than among those without chronic pain. (A table showing data on which these percentages are based is available as an online supplement to this article.)

More than one-half ($N=5,513$) of the soldiers with comorbid chronic pain and PTSD received an opioid days' supply of ≥ 7 days in the postdeployment year. Nearly one-third of these soldiers (31.4%, $N=3,191$) received an opioid days' supply of >30 days, a proportion that was higher than in all other subgroups (Table 1). More than one-third of those with comorbid chronic pain and PTSD ($N=3,551$) received tramadol. Almost all soldiers with chronic pain received other analgesic medications, although the average days' supply of these medications was higher among soldiers with comorbid chronic pain and PTSD than among those with chronic pain only. The percentages of utilization of SSRIs or SNRIs, benzodiazepines, and antipsychotics, medications most commonly associated with psychiatric diagnosis, were higher for soldiers with PTSD or chronic pain than for those without those diagnoses and was highest for those with comorbid chronic pain and PTSD. More than one-third ($N=3,585$) of the soldiers with comorbid chronic pain and PTSD received a benzodiazepine prescription, and one-third ($N=3,361$) received an antipsychotic prescription.

Soldiers with comorbid chronic pain and PTSD had the highest receipt of nonpharmacologic treatment and mental health specialty treatment (Table 2). More than three-fourths (80.3%, $N=8,150$) of the soldiers with comorbid

TABLE 1. Prescription utilization and mean days' supply among active duty soldiers with and without chronic pain, by PTSD status (N=576,425)^a

Prescription type	Without chronic pain				With chronic pain ^b			
	No PTSD (N=486,984)		PTSD (N=19,132)		No PTSD (N=60,156)		PTSD (N=10,153)	
	N	%	N	%	N	%	N	%
Opioid								
Days' supply of ≥7 days in year	59,823	12.3	4,528	23.7	24,113	40.1	5,513	54.3
Days' supply of >30 days in year	15,951	3.3	1,852	9.7	10,271	17.1	3,191	31.4
Tramadol								
Received prescription	28,848	5.9	2,318	12.1	18,232	30.3	3,551	35.0
Annual days' supply (M±SD)	20.6±35.8		27.5±42.2		32.0±54.5		38.7±61.5	
Other analgesic								
Received prescription	277,914	57.1	14,164	74.0	57,537	95.7	9,723	95.8
Annual days' supply (M±SD)	49.3±54.7		67.7±70.1		101.1±81.7		122.8±99.5	
SSRI or SSNRI								
Received prescription	47,728	9.8	13,203	69.0	17,624	29.3	8,496	83.7
Annual days' supply (M±SD)	117.0±122.2		177.7±154.6		138.4±138.7		240.0±191.2	
Benzodiazepine								
Received prescription	29,844	6.1	3,756	19.6	9,156	15.2	3,585	35.3
Annual days' supply (M±SD)	18.2±33.1		50.4±66.0		28.8±49.4		68.9±93.7	
Antipsychotic								
Received prescription	5,931	1.2	4,664	24.4	2,349	3.9	3,361	33.1
Annual days' supply (M±SD)	77.5±89.9		101.9±103.3		87.4±108.5		122.3±126.4	

^a Utilization and supply were assessed during the postdeployment year. The chi-square statistic for each bivariate association of PTSD status and PTSD subgroups with prescription utilization was statistically significant at the $p \leq 0.001$ level, except for other analgesic prescriptions among the PTSD groups. SSNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor.

^b Chronic pain was defined as at least two ambulatory records with primary diagnoses of the same pain category condition spanning at least 90 days during the year, combined with self-reported pain scores of 4–10 (moderate to severe) on the numeric rating scale of two or more encounters spanning at least 90 days.

chronic pain and PTSD received at least one non-pharmacologic treatment, a proportion significantly higher than that for soldiers with chronic pain only and more than double the percentage of soldiers with PTSD only. Most in the group with chronic pain and PTSD received therapeutic exercise. Utilization of mental health specialty treatment was nearly universal among subgroups with PTSD. Utilization of specialty substance use treatment was higher in the subgroups with comorbid chronic pain and PTSD and with PTSD only, compared with the subgroups without PTSD.

Soldiers with comorbid chronic pain and PTSD had the highest utilization of overall health care services and were the most likely to experience a duty limitation, compared with other subgroups (Table 3). Approximately one-third of the soldiers with comorbid chronic pain and PTSD had an inpatient admission; this was greater than for those with chronic pain only (11.5%, $N=6,935$) or those with PTSD only (22.3%, $N=4,274$). Nearly two-thirds of soldiers with comorbid chronic pain and PTSD ($N=6,694$) had an emergency department visit. The PTSD-only group had nearly twice the rate of inpatient admissions, and equivalent rates of emergency department use, as the group with chronic pain only.

The results of the logistic regression model showed that soldiers with a PTSD diagnosis (main effect) had 1.4 times

higher odds of receiving an opioid days' supply of >30 days, relative to soldiers without PTSD diagnosis (Table 4). However, the odds ratios (ORs) represented by the significant interaction terms of PTSD and chiropractic care ($OR > 1$) and acupuncture care ($OR < 1$) indicated that the effect of PTSD depended on treatments received. Soldiers with PTSD who received chiropractic or spinal manipulation services had increased odds of receiving an opioid days' supply of >30 days, relative to those with no chiropractic or spinal manipulation services. Those with PTSD who received acupuncture, biofeedback, or cold laser had reduced odds of receiving an opioid days' supply of >30 days, compared with those without such care. No other statistically significant interactions were detected. The coefficients for covariates indicated significantly reduced odds of receiving an opioid days' supply of >30 days among female soldiers; the youngest age group (relative to the 30–34-year age group); Black non-Hispanic, Hispanic, and other race ethnicity (relative to White, non-Hispanic soldiers); and all ranks (relative to junior enlisted). The odds of receiving an opioid days' supply of >30 days were higher among married soldiers (relative to never married) and among Asian and Pacific Islander soldiers (relative to White, non-Hispanic soldiers).

In sensitivity analysis restricted to confirmed PTSD cases (81% of the PTSD sample; $N=23,721$), these findings were

TABLE 2. Nonpharmacologic and specialist service utilization among active duty soldiers with and without chronic pain, by PTSD status (N=576,425)^a

Type of service	Without chronic pain				With chronic pain ^b			
	No PTSD (N=486,984)		PTSD (N=19,132)		No PTSD (N=60,156)		PTSD (N=10,153)	
	N	%	N	%	N	%	N	%
Any nonpharmacologic treatment	92,536	19.0	7,355	38.4	41,656	69.2	8,150	80.3
Therapeutic exercise	80,461	16.5	5,990	31.3	37,743	62.7	7,347	72.4
Chiropractic or spinal manipulation	19,861	4.1	1,460	7.6	13,013	21.6	2,467	24.3
Acupuncture, biofeedback, cold laser	4,395	.9	1,337	7.0	3,191	5.3	1,955	19.3
Other physical therapy procedures ^c	46,607	9.6	3,705	19.4	28,996	48.2	5,894	58.1
Mental health specialty	259,048	53.2	18,347	95.9	45,399	75.5	10,050	99.0
Substance use specialty	26,347	5.4	3,150	16.5	4,652	7.7	1,714	16.9

^a Utilization was assessed during the postdeployment year. The chi-square statistic for each bivariate association of PTSD status and PTSD subgroups with utilization was statistically significant at $p \leq 0.001$.

^b Chronic pain was defined as at least two ambulatory records with primary diagnoses of the same pain category condition spanning at least 90 days during the year, combined with self-reported pain scores of 4 to 10 (moderate to severe) on the numeric rating scale of two or more encounters spanning at least 90 days.

^c Includes massage, heat, transcutaneous electrical nerve stimulation, traction, ultrasound, and lumbar supports.

replicated, and the coefficients and confidence intervals for the key independent variables were nearly identical, although the p value increased from $p < 0.05$ to $p < 0.066$ for the interaction of PTSD and therapeutic exercise, reflecting the smaller sample size.

DISCUSSION

These findings highlight the unique health care needs of patients with comorbid chronic pain and PTSD in a population of active duty soldiers returning from deployment. We found that 12.2% had clinically significant chronic pain with self-reports of moderate to severe pain intensity that lasted >3 months in the postdeployment year. Among soldiers with chronic pain, 14.4% had a comorbid PTSD

diagnosis, representing 1.8% of the entire active duty study population ($N=10,153$). Soldiers with comorbid chronic pain and PTSD had substantially greater health care utilization, including nonpharmacologic treatment, inpatient hospitalizations, and emergency visits, than the other three subgroups. Furthermore, nearly all had documented limited duty restrictions or days out of work. Although such health care utilization patterns suggest overall burden, these analyses did not determine whether the pharmacologic treatment utilization occurred first, followed by nonpharmacologic treatment.

Research is warranted to understand the extent to which early and intensive health care intervention mitigates the risk for more expensive health care encounters, such as hospitalizations, and whether work impairment is influenced by treatment choices, for example, whether it is associated with opioid or benzodiazepine use.

Recent clinical guidelines developed by the Department of Veterans Affairs and the DoD urge providers to select short-duration opioids when prescribing opioids for pain treatment and suggest using nonpharmacologic treatment as a first option in chronic pain management (28). In one case-control study of $>18,000$ soldiers, those with opioid dependence were 28 times more likely to have had a previous PTSD diagnosis, compared with those without opioid dependence (40). To improve guideline-concordant care, close

monitoring of continued benefits among patients receiving opioids may mitigate the risk for adverse effects, particularly among those with PTSD. Interdisciplinary pain management approaches and nonpharmacologic treatment both have been found effective in treating chronic pain (39, 41, 42), and the MHS has expanded access to interdisciplinary pain management (43, 44). In the present sample, 16.9% of soldiers with comorbid chronic pain and PTSD were seen by substance use treatment specialists (Table 2); future

TABLE 3. Health care utilization and duty limitations among active duty soldiers with and without chronic pain, by PTSD status (N=576,425)^a

Utilization type or duty limitation	Soldiers without chronic pain				Soldiers with chronic pain ^b			
	No PTSD (N=486,984)		PTSD (N=19,132)		No PTSD (N=60,156)		PTSD (N=10,153)	
	N	%	N	%	N	%	N	%
Inpatient admission	22,313	4.6	4,274	22.3	6,935	11.5	3,337	32.9
Emergency department visit	127,384	26.2	9,418	49.2	30,042	49.9	6,694	65.9
Military duty limitation, assigned to quarters, or admitted to hospital ^c	197,601	40.6	12,635	66.0	54,148	90.0	9,559	94.1

^a Utilization and limitations were assessed during the postdeployment year. The chi-square statistic for each bivariate association of PTSD status and PTSD subgroups with utilization was statistically significant at $p \leq 0.001$.

^b Chronic pain was defined as at least two ambulatory records with primary diagnoses of the same pain category condition spanning at least 90 days during the year, combined with self-reported pain scores of 4–10 (moderate to severe) on the numeric rating scale of two or more encounters spanning at least 90 days.

^c Outpatient encounter at a military treatment facility with disposition of assignment to quarters, restricted duty, or admitted to hospital.

research should examine the utility of involving behavioral health clinicians at the time of the decision to initiate opioid-based treatment of soldiers, particularly of those with PTSD. Although our data focused primarily on active duty soldiers, the implications of this study could be relevant also for civilians. Opioid prescription use is higher among civilians with PTSD and chronic pain than among those without PTSD (45). Moreover, the likelihood of an opioid use disorder is higher among civilians with PTSD and chronic pain than among those without either condition (3).

Nonpharmacologic treatments such as acupuncture, yoga, cognitive-behavioral therapy, and meditation have been associated with clinical improvements of PTSD symptoms or clinical improvements in managing both PTSD and chronic pain (46–52). The *VA/DoD Clinical Practice Guideline for Management of Posttraumatic Stress Disorder and Acute Stress Reaction* suggests that mindfulness, yoga, acupuncture, and massage may facilitate a relaxation response (53). Consistent with this, our study found that receipt of acupuncture, biofeedback, or cold laser was more likely to be associated with reduced opioid use among those with comorbid chronic pain and PTSD than among those with chronic pain only. Our results showed that spinal manipulation is effective for soldiers with chronic pain but not in the presence of PTSD. Future research should examine whether spinal manipulation may exacerbate hyperarousal or other PTSD symptoms.

We report very high utilization of mental health specialty treatment among soldiers with PTSD and note that the MHS has worked to identify PTSD among military members, including systematic PTSD screening after deployment (34).

TABLE 4. Associations of health care utilization and clinical and demographic characteristics with receipt of an opioid days' supply of >30 days among active duty soldiers with chronic pain (N=70,309)^a

Utilization or characteristic	Adjusted OR	95% CI	p
PTSD diagnosis (reference: no PTSD diagnosis) ^b	1.4	1.3–1.6	<.001
Type of NPT treatment (reference: no treatment) ^c			
Therapeutic exercise	1.3	1.2–1.4	<.001
Chiropractor or spinal manipulation	.7	.7–.7	<.001
Acupuncture, biofeedback, or cold laser	1.3	1.1–1.4	<.001
Other physical therapy or TENS	1.8	1.7–1.9	<.001
Mental health specialty	1.6	1.6–1.7	<.001
Substance use specialty	1.3	1.3–1.4	<.001
Interactions ^d			
PTSD and therapeutic exercise	1.1	1.0–1.3	.050
PTSD and chiropractor or spinal manipulation	1.2	1.1–1.4	<.001
PTSD and acupuncture, biofeedback, or cold laser	.8	.7–.9	.007
PTSD and other physical therapy or TENS	1.1	1.0–1.2	.172
Female (reference: male)	.9	.8–.9	<.001
Age group (years) (reference: 30–34)			
18–24	.9	.8–.9	.006
25–29	1.0	.9–1.1	.995
35–39	.9	.9–1.0	.026
≥40	1.0	.9–1.1	.861
Marital status (reference: never married)			
Married	1.2	1.1–1.2	<.001
Separated	1.1	1.0–1.2	.018
Race or ethnicity (reference: White, non-Hispanic)			
American Indian or Alaskan Native	.9	.8–1.2	.778
Asian or Pacific Islander	1.2	1.1–1.3	<.001
Black, non-Hispanic	.6	.5–.6	<.001
Hispanic	.7	.6–.7	<.001
Other	.7	.6–.9	.003
Fiscal year of return from index deployment (reference: 2008)			
2009	.6	.5–.6	<.001
2010	.6	.5–.6	<.001
2011	.6	.5–.6	<.001
2012	.5	.4–.5	<.001
2013	.4	.3–.4	<.001
2014	.4	.3–.4	<.001
Rank (reference: junior enlisted [E1–3])			
Senior enlisted	.9	.8–.9	<.001
Junior officer	.8	.8–.9	.005
Senior officer	.8	.6–.8	.008
Warrant officer	.8	.7–.9	.114

^a All variables were assessed during the postdeployment year. Chronic pain was defined as at least two ambulatory records with primary diagnoses of the same pain category condition spanning at least 90 days during the year, combined with self-reported pain scores of 4–10 (moderate to severe) on the numeric rating scale of two or more encounters spanning at least 90 days. NPT, nonpharmacologic treatment; PTSD, posttraumatic stress disorder; TENS, transcutaneous electrical nerve stimulation.

^b The main effect for PTSD patients who did not receive any nonpharmacologic treatment.

^c The main effect for each nonpharmacologic treatment for patients who did not have PTSD.

^d The exponent of the interaction term is the estimated ratio of two odds ratios, each of which compares two groups: patients with PTSD who receive chiropractor/spinal manipulation versus patients with no PTSD who receive chiropractor/spinal manipulation, and patients with PTSD and no chiropractor/spinal manipulation treatment versus patients with no PTSD and no chiropractor/spinal manipulation treatment.

The medical records we used did not indicate the degree to which behavioral health therapy was trauma focused, nor did we assess therapy duration or timing.

Overall, the findings of this study highlight the need for integrative, patient-centered models of care to ensure patients with chronic pain and with PTSD are assessed early for comorbid conditions, given the prevalence of these

conditions and their impact on subsequent health care utilization. As health care systems move to adopt value-based initiatives, it is important to consider the unique health care needs of those with comorbid chronic pain and PTSD, such as the role of coordinating care among multiple providers and consolidation of multidisciplinary treatments in single clinics, including multidisciplinary pain or behavioral health centers. Mitigating the risk for inpatient and emergency department admissions among patients with comorbid chronic pain and PTSD through more intensive treatment schedules and coordinated care may not only improve patient outcomes but also reduce long-term health care costs and burden overall.

Our study had several limitations, primarily associated with the observational study design and reliance on secondary analysis of administrative data. Because the patients were not randomly assigned to treatment, we could not infer any causal relationships. Further, we did not study the sequence of diagnoses and treatment events; thus, we could not distinguish the causal relationship between chronic pain and PTSD or causal relationships between these conditions and health care utilization and between their co-occurrence and health care utilization. It is likely that the prevalence of PTSD was underestimated because its diagnosis was identified in the context of service utilization rather than through population screening and assessment. Finally, opioid prescribing for active duty service members began to decline in 2011 (54), in the middle of our study window. Although we did include a measure of fiscal year at the end of deployment in the logistic regression models to control for changes in prescription over time, additional research is needed to determine whether the study findings persist as prescribing trends continue to change after the end of our study period.

CONCLUSIONS

Soldiers with comorbid chronic pain and PTSD have complex treatment needs and require access to specialty care. This study provides evidence that mental health specialty services were widely utilized by this patient group, but some nonpharmacologic modalities may be underutilized. The results also reflected a high prevalence of opioid receipt and prescriptions for benzodiazepines and antipsychotic medications that warrant close monitoring, particularly among soldiers with comorbid chronic pain and PTSD. Future studies should assess the impact of MHS-wide changes to pain management and mental health care in improving guideline-concordant care.

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Maryland (Highland). Send correspondence to Dr. Saadoun (mayada@brandeis.edu). This study was presented in part at the Military Health System Research Symposium, August 27–30, 2017, Kissimmee, Florida, and at the College on Problems of Drug Dependence, June 9–14, 2018, San Diego.

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REFERENCES

- Goldstein RB, Smith SM, Chou SP, et al: The epidemiology of DSM-5 posttraumatic stress disorder in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions-III. *Soc Psychiatry Psychiatr Epidemiol* 2016; 51: 1137–1148
- Dahlhamer J, Lucas J, Zelaya C, et al: Prevalence of chronic pain and high-impact chronic pain among adults—United States, 2016. *MMWR Morb Mortal Wkly Rep* 2018; 67:1001–1006
- Bilevicius E, Sommer JL, Asmundson GJG, et al: Posttraumatic stress disorder and chronic pain are associated with opioid use disorder: results from a 2012–2013 American nationally representative survey. *Drug Alcohol Depend* 2018; 188:119–125
- Toblin RL, Mack KA, Perveen G, et al: A population-based survey of chronic pain and its treatment with prescription drugs. *Pain* 2011; 152:1249–1255
- Stratton KJ, Clark SL, Hawn SE, et al: Longitudinal interactions of pain and posttraumatic stress disorder symptoms in US military service members following blast exposure. *J Pain* 2014; 15: 1023–1032
- Outcalt SD, Ang DC, Wu J, et al: Pain experience of Iraq and Afghanistan veterans with comorbid chronic pain and post-traumatic stress. *J Rehabil Res Dev* 2014; 51:559–570
- Lew HL, Otis JD, Tun C, et al: Prevalence of chronic pain, post-traumatic stress disorder, and persistent postconcussive symptoms in OIF/OEF veterans: polytrauma clinical triad. *J Rehabil Res Dev* 2009; 46:697–702
- Runnals JJ, Van Voorhees E, Robbins AT, et al: Self-reported pain complaints among Afghanistan/Iraq era men and women veterans with comorbid posttraumatic stress disorder and major depressive disorder. *Pain Med* 2013; 14:1529–1533
- Lang KP, Veazey-Morris K, Berlin KS, et al: Factors affecting health care utilization in OEF/OIF veterans: the impact of PTSD and pain. *Mil Med* 2016; 181:50–55
- Fishbain DA, Pulikal A, Lewis JE, et al: Chronic pain types differ in their reported prevalence of post-traumatic stress disorder (PTSD) and there is consistent evidence that chronic pain is associated with PTSD: an evidence-based structured systematic review. *Pain Med* 2017; 18:711–735

11. Seal KH, Shi Y, Cohen G, et al: Association of mental health disorders with prescription opioids and high-risk opioid use in US veterans of Iraq and Afghanistan. *JAMA* 2012; 307:940–947
12. Cohen BE, Gima K, Bertenthal D, et al: Mental health diagnoses and utilization of VA non-mental health medical services among returning Iraq and Afghanistan veterans. *J Gen Intern Med* 2010; 25:18–24
13. Dobie DJ, Maynard C, Kivlahan DR, et al: Posttraumatic stress disorder screening status is associated with increased VA medical and surgical utilization in women. *J Gen Intern Med* 2006; 21(suppl 3):S58–S64
14. Possemato K, Wade M, Andersen J, et al: The impact of PTSD, depression, and substance use disorders on disease burden and health care utilization among OEF/OIF veterans. *Psychol Trauma* 2010; 2:218–223
15. Harding K, Day MA, Ehde DM, et al: Mental and physical health correlates of pain treatment utilization among veterans with chronic pain: a cross-sectional study. *Mil Med* 2019; 184:e127–e134
16. Pugh MJ, Finley EP, Copeland LA, et al: Complex comorbidity clusters in OEF/OIF veterans: the polytrauma clinical triad and beyond. *Med Care* 2014; 52:172–181
17. Outcalt SD, Yu Z, Hoen HM, et al: Health care utilization among veterans with pain and posttraumatic stress symptoms. *Pain Med* 2014; 15:1872–1879
18. Harris AH, Chen C, Mohr BA, et al: Predictors of Army National Guard and Reserve members' use of Veteran Health Administration health care after demobilizing from OEF/OIF deployment. *Mil Med* 2014; 179:1090–1098
19. Vanneman ME, Harris AH, Chen C, et al: Army active duty members' linkage to Veterans Health Administration Services after deployments to Iraq or Afghanistan and following separation. *Mil Med* 2015; 180:1052–1058
20. Vallerand AH, Cosler P, Henningfield JE, et al: Pain management strategies and lessons from the military: a narrative review. *Pain Res Manag* 2015; 20:261–268
21. Buckenmaier CC, III, Gallagher RM, Rupprecht C, et al: Waging war on pain: new strategies to improve pain care for military and VA personnel. *Fed Pract* 2011; 28(suppl 2):1–16
22. The Implementation of a Comprehensive Policy on Pain Management by the Military Health Care System for Fiscal Year 2015: Report to the Committees on Armed Services of the Senate and House of Representatives. Washington, DC, Office of the Secretary of Defense, 2015. health.mil/Reference-Center/Reports/2015/11/12/Comprehensive-Policy-on-Pain-Management. Accessed July 14, 2017
23. Hoge CW, Ivany CG, Brusher EA, et al: Transformation of mental health care for US soldiers and families during the Iraq and Afghanistan wars: where science and politics intersect. *Am J Psychiatry* 2016; 173:334–343
24. Hepner KA, Sloss EM, Roth CP, et al: Quality of care for PTSD and depression in the Military Health System: phase I report. *Rand Health Q* 2016; 6:14
25. Gibson CA: Review of posttraumatic stress disorder and chronic pain: the path to integrated care. *J Rehabil Res Dev* 2012; 49:753–776
26. McGeary CA, McGeary DD, Moreno J, et al: Military chronic musculoskeletal pain and psychiatric comorbidity: is better pain management the answer? *Healthcare* 2016; 4:E38
27. Volkow ND, McLellan AT: Opioid abuse in chronic pain—misconceptions and mitigation strategies. *N Engl J Med* 2016; 374:1253–1263
28. VA/DoD Clinical Practice Guideline for Opioid Therapy for Chronic Pain—Clinician Summary. Washington, DC, Department of Veterans Affairs and Department of Defense, 2017. www.healthquality.va.gov/guidelines/Pain/cot/VADoDOTCPGProviderSummary022817.pdf
29. Larson MJ, Adams RS, Mohr BA, et al: Rationale and methods of the Substance Use and Psychological Injury Combat Study (SUPIC): a longitudinal study of Army service members returning from deployment in FY2008–2011. *Subst Use Misuse* 2013; 48:863–879
30. Reif S, Adams RS, Ritter GA, et al: Prevalence of pain diagnoses and burden of pain among active duty soldiers, FY2012. *Mil Med* 2018; 183:e330–e337
31. Goulet JL, Brandt C, Crystal S, et al: Agreement between electronic medical record-based and self-administered pain numeric rating scale: clinical and research implications. *Med Care* 2013; 51:245–250
32. Fisher MP: PTSD in the US military, and the politics of prevalence. *Soc Sci Med* 2014; 115:1–9
33. Treatment for Posttraumatic Stress Disorder in Military and Veteran Populations: Final Assessment. Washington, DC, Institute of Medicine, National Academies Press, 2014. <https://www.ncbi.nlm.nih.gov/books/NBK224878>. Accessed May 20, 2020
34. Bliese PD, Wright KM, Hoge CW: Preventive mental health screening in the military, in *Deployment Psychology: Evidence-Based Strategies to Promote Mental Health in the Military*. Edited by Adler AB, Bliese PD, Castro CA. Washington, DC, American Psychological Association, 2011, pp 175–193
35. Calhoun PS, McDonald SD, Guerra VS, et al: Clinical utility of the Primary Care–PTSD Screen among US veterans who served since September 11, 2001. *Psychiatry Res* 2010; 178:330–335
36. Adams RS, Thomas CP, Ritter GA, et al: Predictors of post-deployment prescription opioid receipt and long-term prescription opioid utilization among Army active duty soldiers. *Mil Med* 2019; 184:e101–e109
37. Chou R, Huffman LH: Nonpharmacologic therapies for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. *Ann Intern Med* 2007; 147:493–505
38. Chou R, Deyo R, Friedly J, et al: Nonpharmacologic therapies for low back pain: a systematic review for an American College of Physicians clinical practice guideline. *Ann Intern Med* 2017; 166:493–505
39. Larson MJ, Adams RS, Ritter GA, et al: Associations of early treatments for low-back pain with military readiness outcomes. *J Altern Complement Med* 2018; 24:666–676
40. Dabbs C, Watkins EY, Fink DS, et al: Opiate-related dependence/abuse and PTSD exposure among the active-component US military, 2001 to 2008. *Mil Med* 2014; 179:885–890
41. Gatchel RJ, McGeary DD, McGeary CA, et al: Interdisciplinary chronic pain management: past, present, and future. *Am Psychol* 2014; 69:119–130
42. Cheatle MD: Biopsychosocial approach to assessing and managing patients with chronic pain. *Med Clin North Am* 2016; 100:43–53
43. Jaditz TSE, Schaefer E, Hill C: Evaluation of Chiropractic Services—Impact on MHS. Alexandria, Virginia, The CNA Corporation, 2008
44. Pain Management Task Force Final Report: Providing a Standardized DoD and VHA Vision and Approach to Pain Management to Optimize the Care for Warriors and their Families. Washington, DC, US Army Medical Command, Office of the Surgeon General, 2010. www.dvcipm.org/site/assets/files/1070/pain-task-force-final-report-may-2010.pdf
45. Phifer J, Skelton K, Weiss T, et al: Pain symptomatology and pain medication use in civilian PTSD. *Pain* 2011; 152:2233–2240
46. Strauss JL, Coeytaux R, McDuffie J, et al: Efficacy of Complementary and Alternative Medicine Therapies for Posttraumatic Stress Disorder. Washington, DC, Department of Veterans Affairs, 2011. www.ncbi.nlm.nih.gov/books/NBK82774. Accessed June 20, 2019
47. Wabbeh H, Senders A, Neuendorf R, et al: Complementary and alternative medicine for posttraumatic stress disorder symptoms: a systematic review. *J Evid Based Complementary Altern Med* 2014; 19:161–175
48. Wynn GH: Complementary and alternative medicine approaches in the treatment of PTSD. *Curr Psychiatry Rep* 2015; 17:600
49. Vickers AJ, Cronin AM, Maschino AC, et al: Acupuncture for chronic pain: individual patient data meta-analysis. *Arch Intern Med* 2012; 172:1444–1453

50. Plank S, Goodard J: The effectiveness of acupuncture for chronic daily headache: an outcomes study. *Mil Med* 2009; 174:1276–1281
51. Lee C, Crawford C, Wallerstedt D, et al: The effectiveness of acupuncture research across components of the trauma spectrum response (tsr): a systematic review of reviews. *Syst Rev* 2012; 1:46
52. Fan AY, Miller DW, Bolash B, et al: Acupuncture's role in solving the opioid epidemic: evidence, cost-effectiveness, and care availability for acupuncture as a primary, non-pharmacologic method for pain relief and management-white paper 2017. *J Integr Med* 2017; 15:411–425
53. VA/DoD Clinical Practice Guideline for the Management of Post-traumatic Stress Disorder and Acute Stress Disorder. Washington, DC, Department of Veterans Affairs, 2017. www.healthquality.va.gov/guidelines/MH/ptsd/VADoDPTSDCPGFinal012418.pdf
54. Kazanis W, Pugh MJ, Tami C, et al: Opioid use patterns among active duty service members and civilians: 2006–2014. *Mil Med* 2018; 183:e157–e164

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