Pain Medicine, 00(0), 2022, 1–11
https://doi.org/10.1093/pm/pnab351
Advance Access Publication Date: 6 January 2022
Original research

Risk Factors Associated with Healthcare Utilization for Spine Pain

Diana M. Higgins, PhD,[*,†] Ling Han, MD, PhD,[‡] Robert D. Kerns, PhD,[§,¶] Mary A. Driscoll, PhD,[§,¶] Alicia A. Heapy, PhD,[§,¶] Melissa Skanderson, MSW,[¶] Anthony J. Lisi, DC,[§,¶] Kristin M. Mattocks, PhD[‖,‖] Cynthia Brandt, MD, MPH,[§,¶] and Sally G. Haskell, MD, MS[§,¶]

*VA Boston Healthcare System, Boston, Massachusetts, USA; [†]Boston University School of Medicine, Boston, Massachusetts, USA; [‡]Yale School of Public Health, New Haven, Connecticut, USA; [§]Yale School of Medicine, New Haven, Connecticut, USA; [¶]VA Connecticut Healthcare System, West Haven, Connecticut, USA; [‖]VA Central Western Massachusetts Healthcare System, Leeds, Massachusetts, USA; [‖]Department of Population and Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, Massachusetts, USA

Correspondence to: Diana M. Higgins, PhD, Anesthesiology, Critical Care, and Pain Medicine Service, VA Boston Healthcare System, 116B-2, 150 South Huntington Avenue, Boston, MA 02130, USA. Tel: 857-364-2221; Fax: 617-278-4508; E-mail: diana.higgins2@va.gov.

Funding sources: Funding for this project was provided through VA Health Services Research and Development grant, Women Veterans Cohort Study (VA HSR&D IIR 12-118).

Conflicts of interest: There are no conflicts of interest to disclose.

Disclaimers: The views expressed in this article are those of the authors and do not necessarily represent the position or policy of the Department of Veterans Affairs, Department of Army/Navy/Air Force, or Department of Defense.

Received on 16 July 2021; revised on 15 November 2021; Accepted on 13 December 2021

Abstract

Objective. This study examined potential risk factors associated with healthcare utilization among patients with spine (i.e., neck and back) pain. **Methods**. A two-stage sampling approach examined spine pain episodes of care among veterans with a yearly outpatient visit for six consecutive years. Descriptive and bivariate statistics, followed by logistic regression analyses, examined baseline characteristics of veterans with new episodes of care who either continued or discontinued spine pain care. A multivariable logistic regression model examined correlates associated with seeking continued spine pain care. **Results**. Among 331,908 veterans without spine pain episodes of care during the 2-year baseline observation period, 16.5% (n = 54,852) had a new episode of care during the following 2-year observation period. Of those 54,852 veterans, 37,025 had an outpatient visit data during the final 2-year follow-up period, with 53.7% (n = 19,865) evidencing continued spine pain care. Those with continued care were more likely to be overweight or obese, non-smokers, Army veterans, have higher education, and had higher rates of diagnoses of all medical and mental health conditions examined at baseline. Among several important findings, women had 13% lower odds of continued care during the final 2-year observation period, OR 0.87 (0.81, 0.95). **Conclusions**. A number of important demographics and clinical correlates were associated with increased likelihood of seeking new and continued episodes of care for spine pain; however, further examination of risk factors associated with healthcare utilization for spine pain is indicated.

Key Words: Spine; Back Pain; Cervical; Pain Management; Risk Factors; Healthcare

Introduction

The high prevalence and cost of spine pain (i.e., neck and/or back pain) with respect to healthcare and disability has contributed to growing interest in examining patients who access care for spine pain conditions with the hope of optimizing treatment approaches and limiting avoidable care [1–4]. Similar to the general US population, musculoskeletal (MSK) conditions, including back and neck pain, are common among military veterans [5]. In fact, these conditions account for the majority of

painful diagnoses among veterans, particularly women [5–9]. Examining healthcare utilization for spine pain over time in a large, integrated healthcare system such as the Veteran Health Administration (VHA) may yield important information about individual differences and risk factors for seeking new episodes of spine pain care, and, importantly, for new episodes of care that transition to continued care. This may help identify those who are at-risk of developing persistent spine pain in order to mitigate its impact on individual functioning (e.g., disability) and the healthcare system (e.g., guideline-concordant use of resources, costs) [10–12].

While a number of studies have drawn attention to over-utilization of care and costs of spine pain care (particularly low back pain) [13–16], few studies have examined longitudinal patterns of healthcare utilization for spine pain. Identification of predictors of the transition from acute to chronic back pain may inform efforts to address actionable factors to improve care and patient-centered outcomes. For example, a study of more than 5,000 patients presenting to primary care clinic visits with acute low back pain (LBP) demonstrated that those who had transitioned to chronic LBP (32%) at a 6-month follow-up survey were more likely to have severe or very severe disability, depression, anxiety, obesity, and to be current smokers [17]. This study did not associate these factors with healthcare use.

Other studies focused on predictors of persistent pain and have documented that those reporting greater pain intensity, greater disability, lower education, and presence of co-occurring chronic disease and mental health conditions are associated with poor prognosis and development of persistent pain [18–21]. In a longitudinal study using electronic health record (EHR) data, veterans (N = 5,242) with persistent pain (versus no pain) were more likely to be female, Black, Army service members, have mood disorders (e.g., depression), post-traumatic stress disorder, and overweight/obesity, among other factors [18]. This study followed patients for 5 consecutive years of VHA healthcare. However, veterans' healthcare utilization for their painful condition(s) was not examined.

Examination of healthcare utilization among patients with spine conditions has often focused on examining quantity and type of care (e.g., surgical intervention, primary care visits) [14, 22, 23] or characteristics of patients receiving non-guideline concordant care [11, 24]. A recent meta-analysis and systematic review of 20 studies of healthcare utilization for LBP noted a lack of evidence to determine socio-demographic and clinical correlates associated with healthcare utilization among patients with LBP. This study did not find a link between healthcare utilization and commonly described correlates of LBP, such as depression. Only 4 of 13 studies included in the meta-analysis observed women as higher utilizers of healthcare for LBP; the remaining studies did not describe a gender association which suggests some uncertainly about the role of gender in healthcare utilization for LBP. Higher pain intensity and disability were described as the most common factors associated with higher utilization of care for LBP [23]. The studies in this meta-analysis generally described healthcare utilization among patients with LBP but did not describe healthcare utilization patterns longitudinally from acute to chronic LBP.

To date, no study has longitudinally examined healthcare utilization following a new episode of care for spine pain or risk factors for seeking continued spine pain care. To address this gap, the current study had two objectives, including: (1) among veterans with no identified spine pain diagnoses or associated episodes of care during a two year observation period in which VHA care was received, which veterans subsequently seek a new episode of care for spine pain (i.e., "new episode of care"); and (2) what are the correlates of those veterans who exhibit evidence of continued episodes of care for spine pain (i.e., "continued care") compared to those veterans who demonstrate resolution of care or "discontinued care"? Demographic variables and clinical correlates for the current study were chosen based on published data discussing predictors of acute and persistent spine pain described above.

Methods

Study Population

The study was performed using data from the Women Veterans Cohort Study (WVCS) [6, 7]. The WVCS is comprised of post-9/11 era veterans and includes a higher proportion of women than prior eras, thus allowing for examination of gender as a sub-focus of the current study. The cohort contains electronic health record (EHR) data from 2001 to 2015 for all veterans enrolled in VHA healthcare following service in the post-9/11 era. The study was approved by the VA Connecticut Healthcare System Human Studies Subcommittee (i.e., Institutional Review Board).

Data Sources

Clinical data for the current study were derived from the EHR data in the VHA's National Corporate Data Warehouse that provides a record of healthcare encounters and coded diagnostic (International Classification of Diseases–Ninth Revision; ICD-9) data associated with VHA inpatient and outpatient visits. Demographic data were extracted from the Defense Manpower Data Center—Contingency Tracking System Deployment File.

Study Sample

We developed a two-stage sampling process (see Figure 1). First, among veterans enrolled in VHA care during FY2001 to FY2015 (N = 949,347), we set up a virtual wash-out period (i.e., the first 2 years after VHA enrollment). The study duration (i.e., FY2001-FY2015) was chosen because ICD-9 codes were replaced with ICD-10 codes on October 1, 2015, and the ICD-10 codes

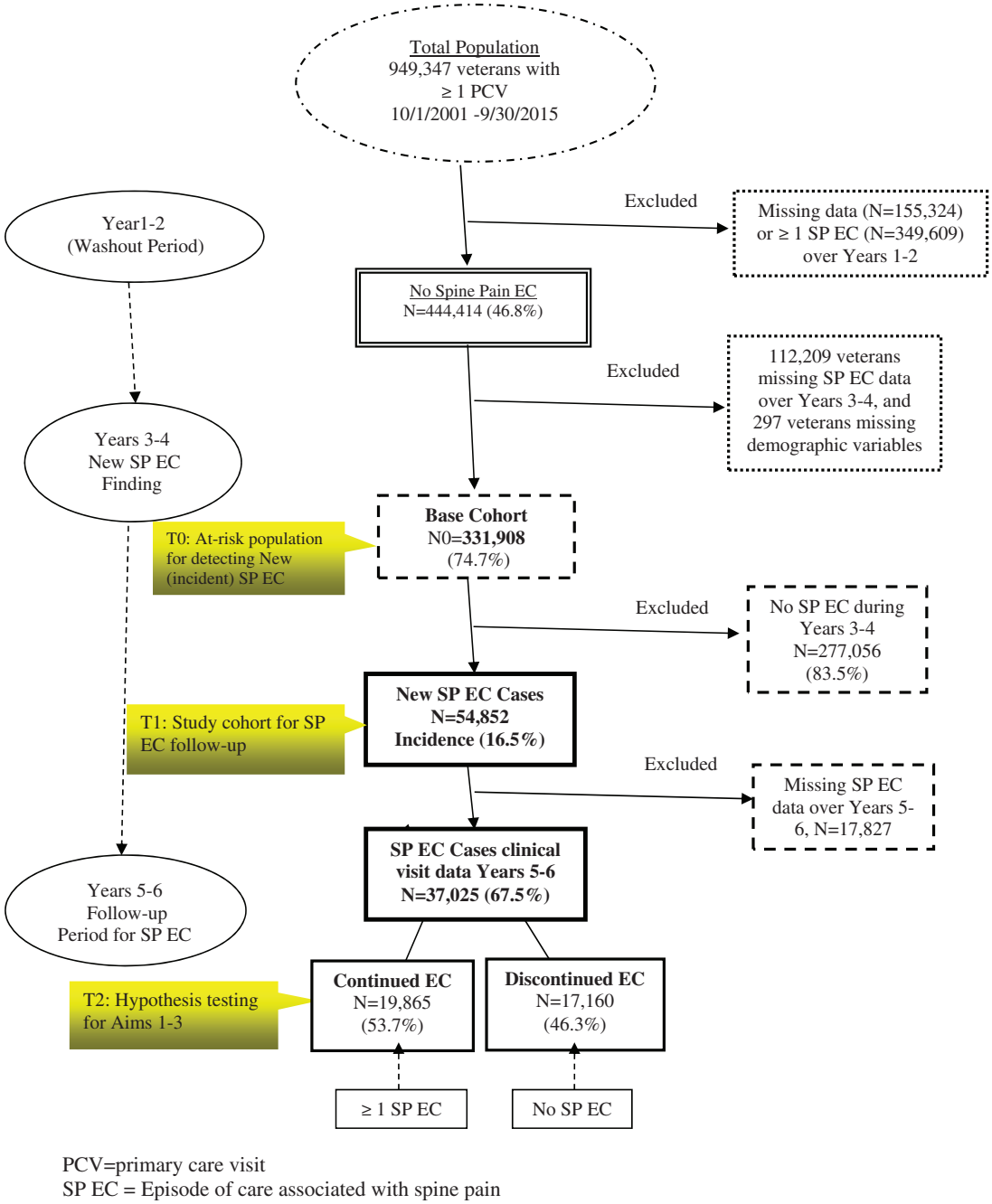

Figure 1. Study sampling process. PCV = primary care visit; SP EC = episode of care associated with spine pain.

for musculoskeletal conditions were significantly altered in this update. Veterans with missing data regarding a primary care visit (N = 155,324) or with ≥ 1 episodes of spine pain care (N = 349,609), determined by ICD-9 diagnoses consistent with neck or back pain over this 2-year period, were excluded because the presence of one or more spine pain codes would indicate existing spine pain and these veterans would not be eligible for the washout period. An initial primary care visit during the washout period was used to allow for calculation of initial visit and last outpatient visit. Next, those *without* episodes of care associated with spine pain in Years 1–2 (N = 444,414) were followed for two subsequent years (Years 3–4) to identify new episodes of care for spine pain. After excluding veterans with missing data (N = 112,209), a cohort of 54,852 veterans who had ≥ 1 new episodes of spine pain care during that 2-year period was assembled. Of these 54,852 new episodes of care for spine pain cases, 17,357 (31.9%) did not episodes of care associated with a spine pain diagnosis over subsequent 2 years (Year 5–6) and were excluded. The remaining 37,025 (68.1%) were followed up over Years 5–6 to determine continued (N = 19,865) versus discontinued (N = 17,160) care associated with spine pain.

Demographic Variables

Age (at initial primary care visit), gender, race/ethnicity (i.e., Black, Hispanic, Other/unknown, White), education (high school diploma or the equivalent, greater than high school), and military branch (Army, Navy, Marines, Air Force, Coast Guard) were examined.

Health Risk Factors

Body Mass Index. Given the high comorbidity of overweight/obesity with painful conditions and high prevalence in veterans [25, 26], body mass index (BMI) was calculated for each patient. BMI was extracted at the initial primary care clinic visit following enrollment in VHA care during Year 1 or, if unavailable, calculated using the first height and weight recorded in the EHR. Classifications of BMI (kg/m^2) were categorized: under/normal weight (BMI < 25), overweight (BMI 25–29.9), obesity (BMI 30+) [27]. *Tobacco Use*. Smoking status is frequently correlated with pain [28, 29]. Smoking status is available in the EHR when veterans are screened for tobacco and is defined in the current study as "no," "current," "past," and "unknown." Smoking status was determined by the most frequent response in the EHR over all data through 09/30/2015.

Pain Variables

Spine Pain Diagnoses

We included diagnostic code groupings for back pain, low back pain, and neck pain [30, 31]. ICD-9 codes examined in this study are listed in Supplementary Data.

Pain Intensity Ratings

At VHA healthcare visits, veterans are routinely screened for the presence and intensity of pain using the pain intensity numeric rating scale (NRS). The pain intensity NRS asks about "current pain on a 0 (no pain) to 10 (worst pain imaginable) scale," and the rating is recorded in the EHR [32, 33]. This variable is based on pain intensity NRS available at any visit in the EHR over the 2-year washout period (i.e., years 1–2). If a veteran had more than one pain intensity rating during each year, only the highest was retained. Presence of moderate to severe pain over each 2-year period (i.e., washout years 1–2; the new episode of care for spine pain identification years 3–4) was defined as having at least one pain intensity NRS rating ≥ 4. For the current study, data on pain intensity NRS ratings were collected within each 2-year study period based on the highest scores across all valid scores from each veteran. For analyses, we categorized pain intensity NRS ratings 4–10 as "moderate to severe pain" [34, 35] and 0–3 as "mild" pain intensity. To minimize potential impact of missing data on effect estimates in the multivariable analyses, we designated a "missing/unable to rate" category for veterans who were missing pain intensity NRS rating(s) or one pain intensity NRS rated "99" (i.e., unable to respond) in the EHR.

Prescription Opioids and Benzodiazepines

We examined outpatient prescriptions for opioids and benzodiazepines issued by a VHA pharmacy. Medication use was defined as having one or more dispensing records for an opioid or benzodiazepine prescription (any dose or duration) during years 1–2 (as a risk factor for seeking new episodes of care in years 3–4) and Years 3–4 (as a risk factor for seeking continued versus discontinued episodes of care in years 5–6). Opioid oral and transdermal medications examined in this study include: Buprenorphine patch, Codeine, Fentanyl, Hydrocodone, Hydromorphone, Methadone, Morphine, Oxycodone, Oxymorphone, Pentazocine, Propoxyphene, Tapentadol, and Tramadol (partial opioid agonist) [36]. Oral benzodiazepine and non-benzodiazepine hypnotic medications included: Alprazolam, Chlordiazepoxide, Clonazepam, Clorazepate, Diazepam, Estazolam, Flurazepam, Lorazepam, Oxazepam, Temazepam, Triazolam, and Zaleplon (non-benzodiazepine hypnotic).

Medical and Mental Health Conditions

We counted ICD-9 codes for medical and mental health conditions that were coded at least twice for an outpatient visit or once for an inpatient visit any time from FY2002 through FY2015, a method that has been validated in VHA samples [5, 18]. For the current study, all variables found to be predictive of "persistent pain" in a previous study using a similar sample were included, in addition to other high impact conditions comorbid with chronic pain and prevalent in veteran populations [18].

We examined the following medical diagnoses: traumatic brain injury (TBI), coronary artery disease (CAD), chronic obstructive pulmonary disease (COPD), and type 2 diabetes. Other common painful musculoskeletal (MSK) diagnoses frequently seen among patients with spine pain [5, 18] were included as correlates, specifically, osteoarthritis (OA), joint disorders, and fibromyalgia. We included back pain, low back pain, neck pain, and spondylosis diagnoses as correlates to determine whether one of these conditions, more specifically, might predict a new episode or continued episodes of care for spine pain. We examined the following mental health conditions: depressive disorders (i.e., major depressive disorder, depressive disorder NOS, dysthymia), anxiety disorders (i.e., anxiety disorder NOS, panic disorder, generalized anxiety disorder, agoraphobia with and without panic, other anxiety states), bipolar disorders (bipolar I disorder, bipolar II disorder), post-traumatic stress disorder (PTSD), alcohol use disorders, and substance use disorders.

Statistical Analysis

Demographic and clinical characteristics were summarized as means (± standard deviations [SD]) or frequencies (%), among the overall sample of new episodes of care for spine pain and according to the two patterns of

healthcare utilization (i.e., a new episode of care for spine pain versus no new episode of care). Next, to identify independent predictors (or risk factors) of continued versus discontinued care for spine pain (Aim 2), we followed those new episodes of care for 2 subsequent years to detect those who had $\geq$ 1 episode of care for spine pain over years 5–6 (*continued care*) versus those who did not have an episode of care for spine pain (*discontinued care*). We examined the relationships between each baseline characteristic of those with new episodes of care and continued care relative to those with *discontinued care* using a logistic regression model. We first evaluated the bivariate relationship between each predictor and continued episodes of care for spine pain individually, relative to *discontinued care*. Next, to determine the independent contribution of each correlate on presence of continued care, we fit a multivariable logistic regression model accounting for (i.e., simultaneously adjusting for all variables) correlates such as demographics, health risk factors, and medical and mental health conditions. Because initial pain intensity and analgesic treatment may affect the course and outcomes of healthcare utilization among patients with spine pain, the final model further accounted for opioid and benzodiazepine use and pain intensity NRS ratings $\geq$ 4 during years 3–4, each as a binary indicator. Adjusted odds ratio (OR) and their 95% confidence intervals (CI) were used to quantify the strength of the association, with use of robust sandwich variance estimators for standard errors. Model fit was assessed using residual plots and Hosmer and Lemeshow goodness-of-fit test. We also examined and detected no substantial multicollinearity among adjusted correlates in the final adjusted model using variance inflation factor.

SAS version 9.4 software (SAS Institute Inc. 2011; Cary, NC, USA) was used in all analyses. P values $< .05$ were interpreted to be statistically significant.

Results

The base cohort (N = 331,908) was 87% male, 63.2% White, 17.7% Black, 11.2% Hispanic, and had a mean age of 32.2 years (SD = 9.6). Table 1 describes the characteristics of the overall sample at baseline and compares the subsamples of those with no episodes of care associated with spine pain (N = 277,056) and a new episode of care (N = 54,852, 16.5%) during the first 2-year follow-up period (i.e., years 3–4). Those with a new episode of care for spine pain were more likely to be female, Black, or Hispanic, have less than or equal to a high school education, and to be in the Army, all $P < .0001$. They were more likely to be overweight and obese, to have higher rates of all medical and mental health conditions and were more likely to report moderate to severe pain intensity at baseline, presumably for conditions other than spine pain (all $P < .0001$).

Among the 54,852 veterans with new episodes of spine pain care in the first 2-year follow-up period (i.e., years 3–4), 37,025 had outpatient visit data over a subsequent 2-year follow-up period (i.e., years 5–6). We examined correlates of continued care for spine pain in comparison with those with discontinued care for spine pain (i.e., no additional episodes of care for spine pain), presented in Table 2. Veterans who had served in the Army (as opposed to other military service branches) were more likely to progress to continued care, all $P < .0001$, as were those with greater than high school education. Those with continued episodes of care were more likely to have a BMI consistent with overweight or obesity in comparison to those under/normal weight ($P < .0001$). Those with continued care were less likely to be current smokers and were more likely to report never smoking or past smoking. Those with continued care for spine pain had higher rates of diagnoses of all medical and mental health conditions, were more likely to be prescribed an opioid or benzodiazepine medication in years 3–4 and were more likely to have a moderate to severe pain intensity rating during this 2-year period (all $P < .0001$).

Table 3 presents a multivariable logistic regression model in which correlates predicting seeking continued care versus discontinuing care for spine pain diagnoses were examined. Results of this model, in which covariates including demographics, medical and mental health diagnoses, opioid and benzodiazepine prescriptions, and pain intensity NRS $\geq$ 4 in years 3–4, were controlled, indicate that, over the 2-year follow-up period, women had 13% *lower* odds of receiving continued care for spine pain (vs discontinuing care) than men, OR 0.87 (0.81, 0.95), $P < .001$. Participants were more likely to be Black OR 1.11 (1.04, 1.19), $P < .003$, have a diagnosis of all MSK conditions of interest (i.e., LBP, back pain, neck pain, fibromyalgia, spondylosis, osteoarthritis) except joint disorders, have diagnoses of PTSD, depression, and were more likely to be prescribed benzodiazepines and opioids. Participants receiving continued care for spine pain were less likely to be current smokers, OR 0.92 (0.87, 0.97), $P < .004$ or to have alcohol use disorders, OR 0.92 (0.86, 0.98), $P < .009$.

Discussion

The current study used longitudinal EHR data to examine healthcare utilization for spine pain longitudinally among a large sample of veterans with no evidence of such care during a 2-year baseline period, followed by evidence of new episodes of care for spine pain during two, 2-year follow-up periods. This study estimated a 16.5% rate of a new episode of care for spine pain among 331,908 veterans, with 53.7% of those with a new episode of care (N = 54,852) seeking continued care for spine pain over the course of four years.

Taking into account the variables for which we can determine there is "unbiased" predictive value, veterans with a new episode of spine pain care who sought

Table 1. Characteristics of veterans who did not have a new episode of care associated with spine pain at baseline (i.e., end of 2-year washout period), overall, and those who had a new episode of care during subsequent 2-year follow-up period

Characteristics by Domain	Overall N = 331,908	No EC N = 277,056	New Episode of Care† N = 54,852	*P* Value‡‡
Demographics				
Age (year), mean±SD	32.2 ± 9.6	32.3 ± 9.6	32.2 ± 9.4	.263
Female	43,004 (13.0)	35,172 (12.7)	7832 (14.2)	<.001
Race: *White*	209,913 (63.2)	175,903 (63.5)	34,010 (62.0)	<.001
Black	58,774 (17.7)	48,352 (17.5)	10,422 (19.0)	
Hispanic	37,095 (11.2)	30,481 (11.0)	6614 (12.1)	
Other/Unknown	26,126 (7.8)	22,320 (8.1)	3806 (6.9)	
Education: ≤ *High School*	264,600 (79.7)	219,867 (79.4)	44,733 (81.6)	<.001
>*High School*	67,308 (20.3)	57,189 (20.6)	10,119 (18.5)	
Service branch: *Army*	190,968 (57.5)	157,590 (56.9)	33,378 (60.9)	<.001
Navy	49,977 (15.1)	42,615 (15.4)	7362 (13.4)	
Air Force	42,668 (12.9)	36,470 (13.2)	6198 (11.3)	
Marines	47,840 (14.4)	39,983 (14.4)	7857 (14.3)	
Coast Guard	455 (0.1)	398 (0.1)	57 (0.1)	
Health Risk Factors				
Body mass index (BMI), mean±SD	28.7 ± 4.9	28.7 ± 4.9	28.8 ± 4.9	<.001
Under/Normal weight (BMI < 25)	69,565 (21.0)	57,504 (21.0)	12,061 (22.0)	<.001
Overweight (BMI 25–29)	121,727 (37.7)	99,799 (36.0)	21,928 (40.0)	
Obesity (BMI>=30)	106,965 (32.2)	86,839 (31.3)	20,126 (36.7)	
Unknown	33,651 (10.1)	32,914 (11.9)	737 (1.3)	
Smoker*: No*	122,740 (37.0)	101,276 (36.6)	21,464 (39.1)	<.001
Current	132,243 (39.8)	107,256 (38.7)	24,987 (45.6)	
Past	42,775 (12.9)	34,981 (12.6)	7794 (14.2)	
Unknown	34,150 (10.3)	33,545 (12.1)	607 (1.1)	
Medical/Mental Health conditions†				
Back pain	15,742 (4.7)	6207 (2.2)	9535 (17.4)	<.001
Low back pain	45,002 (13.6)	18,671 (6.7)	26,331(48.0)	<.001
Neck pain	30,540 (9.2)	12,799 (4.6)	17,741 (32.3)	<.001
Fibromyalgia	4384 (1.3)	2513 (0.9)	1871 (3.4)	<.0001
OA	29,349 (8.8)	21,506 (7.8)	7843 (14.3)	<.0001
Joint disorders	21,403 (6.5)	16,173 (5.8)	5230 (9.5)	<.001
Spondylosis	63,339 (19.2)	27,689 (10.0)	35,650 (65.0)	<.001
TBI	46,929 (14.1)	33,765 (12.2)	13,164 (24.0)	<.001
CAD	7446 (2.2)	5695 (2.1)	1751 (3.2)	<.0001
COPD	18,174 (5.5)	13,375 (4.8)	4799 (8.8)	<.001
Type 2 diabetes	18,544 (5.6)	14,630 (5.3)	3914 (7.1)	<.001
PTSD	121,226 (36.5)	92,205 (33.3)	29,021 (52.9)	<.001
Depression (major or mild)	124,548 (37.5)	95,356 (34.4)	29,192 (53.2)	<.001
Alcohol use disorders	62,643 (18.9)	48,698 (17.6)	13,945 (25.4)	<.001
Drug use disorders	27,932 (8.4)	20,822 (7.5)	7110 (13.0)	<.001
Anxiety disorders	90,843 (27.4)	69,398 (25.1)	21,445 (39.1)	<.001
Bipolar disorders	27,538 (8.3)	20,519 (7.4)	7019 (12.8)	<.001
Benzodiazepine use‡	35,087 (10.6)	26,732 (9.7)	8355 (15.2)	<.001
Opioid use¶	50,043 (15.1)	38,368 (13.8)	11,675 (21.3)	<.001
Pain intensity NRS				
< 4	146,180 (44.0)	127,568 (46.0)	18,612 (33.9)	<.001
≥ 4	1,116,917 (35.2)	91,367 (33.0)	25,550 (46.6)	
Missing or Unable to rate	68,811 (20.7)	58,121 (21.0)	10,690 (19.5)	

EC = episode of care; COPD = chronic obstructive pulmonary disease; PTSD = post-traumatic stress disorder; CAD = coronary artery disease; OA = osteoarthritis; TBI = traumatic brain injury; SD = standard deviation.

*Values represent mean±SD or frequency (%).

†Based on encounters of 1 inpatient or 2 outpatient ICD-9 codes for each condition any time from FY2002 through FY2015.

‡Benzodiazepine use was defined as having 1 or more dispensing records during year 1 and/or year 2.

¶Opioid use was defined as having 1 or more dispensing records for any opioid prescriptions during year 1 and/or year 2.

§Based on self-rated pain intensity numeric rating scale (NRS) over the 2-year washout period, with score ranging from 0 (no pain) to 10 (most intense pain). If a veteran had more than one score during each year, only the HIGHEST ones were chosen.

The pain intensity categories were determined based on below hierarchy:

<4: If no pain intensity NRS *scores ≥ 4 over the 2 years*.

≥4: If at least 1 pain intensity NRS *scores ≥ 4 over the 2 years*.

Missing or Unable to rate: If pain intensity NRS *is missing or rated "99" over the 2 years*.

†Defined by 1 or more spine pain diagnostic codes during study years 3–4 after washout period.

‡‡Derived from Student *t*-test for continuous variables and χ^2 test for categorical variables, except otherwise indicated.

Table 2. Correlates of continued care seeking for spine pain over 2-year follow-up period compared with cases with discontinued care

Characteristics by Domain	New Episodes of Care** N = 37,025	Discontinued Care N = 17,160	Continued Care† N = 19,865	*P* Value‡‡
Demographics				
Age at baseline (year), mean±SD	32.1 ± 9.5	31.4 ± 9.3	32.7 ± 9.6	<.001
Female	5266 (14.2)	2498 (14.6)	2768 (13.9)	.087
Race: *White*	22,670 (61.2)	10,650 (62.1)	12,020 (60.5)	.001
Black	7214 (19.5)	3194 (18.6)	4020 (20.2)	
Hispanic	4439 (12.0)	2064 (12.0)	2375 (12.0)	
Other/unknown	2702 (7.3)	1252 (7.3)	1450 (7.3)	
Education: *≤ HS*	32,078 (81.8)	14,183 (82.7)	16,905 (81.0)	<.001
>HS	6747 (18.2)	2977 (17.4)	3770 (19.0)	
Service branch: *Army*	22,926 (61.9)	10,320 (60.1)	12,606 (63.5)	<.001
Navy	4855 (13.1)	2354 (13.7)	2501 (12.6)	
Air Force	4024 (10.9)	1865 (10.9)	2159 (10.9)	
Marines	5185 (14.0)	2604 (15.2)	2581 (13.0)	
Coast Guard	35 (0.1)	17 (0.1)	18 (0.1)	
Health Risk Factors				
Body mass index (BMI), mean±SD	28.7 ± 4.9	28.6 ± 5.0	28.9 ± 4.9	<.001
Under/Normal weight (BMI < 25)	8394 (22.7)	4093 (23.9)	4301 (21.7)	<.001
Overweight (BMI 25–29)	14,885 (40.2)	6816 (39.7)	8069 (40.6)	
Obesity (BMI>=30)	13,398 (36.1)	6016 (35.1)	8895 (36.8)	
Unknown	348 (0.9)	235 (1.4)	113 (0.6)	
Smoker*: No*	14,589 (39.4)	6671 (38.9)	7918 (39.9)	<.001
Current	16,920 (45.7)	7901 (46.1)	9010 (45.4)	
Past	5310 (14.3)	2419 (14.1)	2891 (14.6)	
Unknown	206 (0.6)	160 (0.9)	46 (0.2)	
Medical/Mental Health Conditions†				
Back pain	7404 (20.0)	1681 (9.8)	5723 (28.8)	<.001
Low back pain	20,045 (54.1)	5503 (32.1)	14,542 (73.2)	<.001
Neck pain	14,009 (37.8)	4289 (25.0)	9720 (48.9)	<.001
OA	6342 (17.1)	2330 (13.6)	4012 (20.2)	<.001
Joint disorders	4138 (11.2)	1652 (9.6)	2486 (12.5)	<.001
Spondylosis	26,274 (71.0)	8262 (48.2)	18,012 (90.7)	<.001
Fibromyalgia	1586 (4.3)	394 (2.3)	1192 (6.0)	<.001
TBI	9919 (26.8)	74,184 (24.4)	5735 (28.9)	<.001
CAD	1464 (4.0)	592 (3.5)	872 (4.4)	<.001
COPD	3874 (10.5)	1551 (9.0)	2323 (11.7)	<.001
Type 2 diabetes	3115 (8.4)	1211 (7.1)	1904 (9.6)	<.001
PTSD	21,051 (56.9)	8957 (52.2)	12,094 (60.9)	<.001
Depression (major or mild)	29,192 (53.2)	16,292 (47.7)	14,130 (58.4)	<.001
Alcohol use disorders	10,432 (28.2)	4662 (21.7)	5770 (29.1)	<.001
Drug use disorders	5423 (14.7)	2305 (13.4)	3118 (15.7)	<.001
Anxiety disorders	15,390 (41.6)	6570 (38.3)	8820 (44.4)	<.001
Bipolar disorders	5361 (14.5)	2187 (12.7)	3174 (16.0)	<.001
Benzodiazepine use‡	8840 (23.9)	3550 (20.7)	5290 (26.6)	<.001
Opioid use¶	14,247 (38.5)	5608 (32.7)	8639 (43.5)	<.001
Pain intensity NRS over 2 years§				
<4 (mild)	9161 (24.7)	5001 (29.1)	4160 (20.9)	<.001
≥4 (moderate-severe)	27,060 (73.1)	11,698 (68.2)	15,362 (77.3)	
Missing or Unable to rate	804 (2.2)	461 (2.7)	343 (1.7)	

COPD = chronic obstructive pulmonary disease; PTSD = post-traumatic stress disorder; CAD = coronary artery disease; OA = osteoarthritis; TBI = traumatic brain injury; SD = standard deviation.

*Values represent mean±SD or frequency (%).

†Based on encounters of 1 inpatient or 2 outpatient ICD-9 codes for each condition any time from FY2001 through FY2015.

‡Benzodiazepine use was defined as having 1 or more dispensing records during years 3–4.

¶Opioid use was defined as having 1 or more dispensing records for any opioid prescriptions during years 3–4.

§Based on self-rated pain intensity numeric rating scale (NRS) during years 3–4, with score ranging from 0 (no pain) to 10 (most intense pain). If a veteran had more than one score during each year, only the highest ones were chosen.

The pain intensity categories were determined based on below hierarchy:

<4: If no pain intensity NRS *ratings ≥ 4 in the 2 years*.

≥4: If at least 1 pain intensity NRS *ratings ≥ 4 in the 2 years*.

Missing or Unable to rate: If pain intensity NRS *is missing or rated "99" in the 2 years*.

**Included 37,025 (67.5% of the 54,852 new SP EC cases) veterans with new episodes of care who had VHA outpatient visits during the subsequent two years (i.e., study years 5–6). The other 17,827 (32.5%) cases who did not have VHA outpatient visits during years-5–6 were excluded.

†Defined by 1 or more episodes of care associated with a spine condition diagnostic codes during the subsequent 2 years (i.e., study years 5–6) after a new episode of care at the end of year 4.

‡‡Derived from Student *t*-test for continuous variables and χ^2 test for categorical variables, except otherwise indicated.

Table 3. Adjusted odds ratios (OR) and 95% confidence intervals (CI) of continued care versus discontinued care for spine pain diagnoses from multivariable logistic model*

Characteristics	OR (95 % CI)	*P* Value
Female	0.87 (0.81, 0.95)	<.001
Age at baseline (years)	1.00 (1.00, 1.01)	<.001
Race: *White*	1.00 (ref)	–
Black	1.11 (1.04, 1.19)	.003
Hispanic	0.97 (0.89, 1.05)	.410
Other/unknown	0.98 (0.89, 1.08)	.633
Education: *> HS (vs ≤ HS)*	1.00 (0.97, 1.03)	.899
Body mass index (BMI)		
Under/Normal weight (<25)	1.00 (ref)	–
Overweight (25–29)	1.01 (0.95, 1.08)	.720
Obesity (>=30)	1.05 (0.98, 1.12)	.190
Unknown	0.69 (0.52, 0.91)	.009
Smoker: *No*	1.00 (ref)	–
Current	0.92 (0.877, 0.97)	.004
Past	1.00 (0.92, 1.07)	.899
Unknown	0.45 (0.31, 0.67)	<.001
Service branch: *Army*	1.00 (ref)	–
Navy	1.06 (0.98, 1.14)	.143
Air Force	1.07 (0.99, 1.17)	.096
Marines	0.98 (0.90, 1.05)	.530
Coast Guard	1.30 (0.62, 2.73)	.484
Back pain	2.50 (2. 31, 2.69)	<.001
Low back pain	4.00 (3.72, 4.29)	<.001
Neck pain	3.94 (3.70, 4.19)	<.001
Joint disorders	1.00 (0.92, 1.09)	.037
Spondylosis	3.34 (3.09, 3.61)	<.001
Fibromyalgia	1.29 (1.12, 1.49)	<.001
Osteoarthritis	1.11 (1.06, 1.16)	<.001
TBI	1.05 (0.99, 1.12)	.108
Coronary artery diseases	0.87 (0.76, 0.99)	.038
COPD	0.98 (0.90, 1.07)	.664
Diabetes	0.98 (0.89, 1.08)	728
PTSD	1.10 (1.04, 1.17)	.002
Depression (major or mild)	1.13 (1.07, 1.20)	<.001
Alcohol use disorders	0.92 (0.86, 0.98)	.009
Drug use disorders	1.02 (0.94, 1.11)	.627
Anxiety disorders	1.03 (0.97, 1.09)	.287
Bipolar disorders	1.03 (0.96, 1.12)	.404
Benzodiazepine use‡	1.08 (1.02, 1.15)	.014
Opioid use¶	1.12 (1.06, 1.18)	<.001
Pain intensity NRS rating over 2 years§		
<4	1.00 (ref)	–
≥ 4	1.01 (0.95, 1.07)	.727
Missing or Unable to rate	0.92 (0.78, 1.10)	.370

COPD = chronic obstructive pulmonary disease; PTSD = post-traumatic stress disorder.

*Adjusted odds ratios were estimated using a multivariable logistic regression that included all the a priori determined variables listed in the table.

†Based on encounters of 1 inpatient or 2 outpatient ICD-9 codes for each condition any time from FY2001 through FY2015.

‡Benzodiazepine use was defined as having 1 or more dispensing records during years 3–4.

¶Opioid use was defined as having 1 or more dispensing records for any opioid prescriptions during years 3–4.

§Defined based on the highest pain intensity NRS rating during years 3–4.

†Defined by 1 or more clinical encounters with associated spine condition diagnostic codes during subsequent the 2 years (i.e., follow-up years 5–6) after obtaining a new episode of care with an associated spine condition diagnosis during years 3–4.

continued care for spine pain were more likely to be men, Black, overweight, have other painful conditions, have diagnoses of TBI, COPD, type 2 diabetes, mood disorders, PTSD, substance use disorders, and to be prescribed an opioid medication in years 3–4. These findings potentially highlight the importance of conducting a comprehensive pain assessment among patients at the initial clinical visit for spine pain and targeting actionable medical and mental health conditions and/or health factors (e.g., overweight/obesity) that may pose elevated risk of developing persistent spine pain.

Few studies of healthcare utilization for spine pain (e.g., LBP) have examined demographic and clinical characteristics as correlates or predictors of healthcare utilization for spine pain conditions [23]. Consistent with limited published literature, we demonstrated that women veterans and those who were Black or Hispanic, and those who had medical and mental health conditions, were overweight or obese, and current smokers are at risk for developing new spine pain, or at least for seeking care for a spine pain condition. It is also noteworthy that higher pain intensity during the baseline period, in the absence of episodes of care for spine pain, was predictive of future episodes of spine pain care [23, 37]. This observation raises the question about the location or source of pain at baseline. It is possible that veterans reported significant pain during a routine episode of care or an episode of care for another problem, including care for a non-spine condition. Regardless, this suggests that pain reports during any clinical encounter may predict future episodes of care for spine pain, a finding consistent with the concept of chronic overlapping pain conditions [38]. This observation reinforces the importance of conducting a comprehensive pain assessment following reports of significant pain intensity during routine screening for the presence and intensity of pain, consistent with published guidance from VHA, the Joint Commission, and others [3, 39, 40].

Few studies have examined race and ethnicity as a risk factor for incident or continued healthcare utilization for spine pain. In our study, Blacks and Hispanics were more likely to have a new episode of spine pain care than Whites or Others, and Blacks were more likely than other groups to seek continued spine pain care; however, these differences were small in magnitude.

In the current study, many of the medical and mental health conditions examined were significantly associated with continued healthcare utilization for spine pain (vs discontinuing care). Specifically, the current study suggests that diagnoses of PTSD, depression, and several MSK diagnoses (i.e., back pain, LBP, neck pain, spondylosis, fibromyalgia, osteoarthritis) are predictive of seeking continued care for spine pain. The significance of these findings is likely due to the large sample size and may not be clinically meaningful. However, it is important to note that other studies did not consistently identify medical or mental health conditions as related to

healthcare utilization for spine pain [23]. One study examined factors associated with *types* of healthcare utilized for spine pain (e.g., surgery, laboratory-dominant care, opioid prescriptions, specialty care visits) and noted more comorbidities such as depression, arthritis, and diabetes associated with more invasive (e.g., surgery) and intensive (e.g., 3+ opioid prescriptions) care sought [22].

Results also draw attention to use of opioid therapy for management of spine pain and/or the use of benzodiazepines for pain and/or other conditions encourage caution. Other research has drawn attention to harms associated with long-term and high dose opioid therapy and coprescribed benzodiazepines [41–43]. Clinicians are encouraged to consider patient-centered discontinuation of these therapies and development of integrated plans of care that incorporate alternative pharmacological and evidence-based nonpharmacological approaches.

Strengths of the current study include long duration of follow-up (i.e., 6 years) and following patients (after a wash-out period) from a new episode of care for 4 years. Other studies of healthcare utilization for LBP, for example, tended to follow patients for 12 months or less [22, 23]. One interesting finding in the current study is that women had 13% lower odds than men of seeking continued care for spine pain. This observation appears to be inconsistent with a substantial literature examining this topic; however, some studies report mixed results with respect to patterns of healthcare utilization by gender. Several studies have reported that women are more likely to seek care for LBP [37, 44], while others did not report a significant relationship between gender and healthcare utilization for spine pain [45–47]. It is possible that, for women veterans in the current study, new onset spine pain associated with a new episode of care did not resolve but rather the spine pain diagnosis was assigned a new diagnostic code (e.g., the pain became subsumed under another painful condition, such as fibromyalgia, which includes the spine among other pain locations), and therefore, it appears as if they discontinued seeking episodes of care for spine pain, specifically. Additionally, it is possible that military occupational hazards and physiologic differences result in young women being less likely to develop persistent spine pain requiring continued care, and more likely to develop other types of painful MSK conditions such as lower extremity and joint disorders [9]. Given the lack of consensus among studies examining gender in healthcare utilization for MSK conditions, including spine pain, additional research is needed using comparable methods.

This study has several limitations. The large overall sample of veterans with spine pain seeking a new episode of care and continued care presents a challenge in interpreting small effect sizes. Specifically, the large sample likely produced some of the statistically significant differences seen among the subgroups of care seeking and many of the differences are small. There is no established standard for interpreting the minimal clinically significant difference in demographics and clinical characteristics for large cohort studies beyond regression analyses [48]; however, these may still reflect important considerations for clinical care (e.g., for clinicians, healthcare organization leaders, policy makers) in that they may highlight subgroups of individuals who are more or less likely to seek additional care (beyond an initial visit) for spine pain. Such groups of veterans include racial/ethnic minorities (i.e., Blacks), those with higher pain intensity at the initial episode of care, those with a BMI consistent with overweight and obesity, current or former smokers, and those with PTSD and depression. The current study was conservative in its definition of "back and neck pain" as we relied on ICD-9 diagnostic codes to identify our sample and follow patterns of healthcare utilization. While these spine conditions are often painful, and because patients may seek care resulting in a spine condition diagnosis for other reasons, like weakness, as a presenting problem, claims about the role of pain are perhaps speculative. We accepted this inference and label (i.e., "spine pain") because it is likely that episodes of care for spine conditions were precipitated and associated with the presence of clinically significant pain. In this study, use of EHR data limits the variables we could examine. For example, many other studies employed the use of surveys, which may be able to collect more detailed information about presence of pain and pain interference, (rather than using diagnoses as a proxy), and ratings of disability that may be strong predictors of the presence of pain, but which were not examined in the current study as they are not associated with ICD-9 codes. However, using VHA EHR data allowed us to examined demographic variables and medical and mental health conditions that other studies have not included but that are often associated with persistent pain and higher healthcare utilization.

Additional limitations include our stringent criteria for determining a new episode of care for spine pain and then definitions of continued and discontinued care seeking for spine pain, including the use of the 2-year wash-out period. Despite this, the current study examined a period of 6 years of patient care for patients included in the final sample (N = 54,852). Although our initial sample contained nearly 1,000,000 veterans, the final sample was still large and allowed for adequate statistical power to detect change. Furthermore, the episodes of care examined were restricted to care received in VHA facilities and do not reflect patients who may have received spine pain care in non-VHA facilities. Finally, our categorized measures of pain intensity NRS ratings, and opioid and benzodiazepine prescriptions were defined across 2 years and may not capture the full spectrum of their effects in original scale.

This study addressed significant literature gaps such as longitudinally examining correlates associated with healthcare utilization for spine pain. While other studies have examined some of the same correlates, results have

inconsistently supported the role of the correlates in predicting healthcare utilization, largely among samples with LBP only. The current study yields valuable information about risk and protective factors for seeking new and continued episodes of care for spine pain (as well as examining those who discontinue care for spine pain). Results provide additional guidance for identifying those who are at-risk of developing persistent spine pain to address individual treatment outcomes and affect systemic practices in healthcare (e.g., improving the use of guideline-concordant care).

Supplementary Data

Supplementary data are available at *Pain Medicine* online.

References

1. 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(36):1001–6.
2. Chou R, Shekelle P. Will this patient develop persistent disabling low back pain? JAMA 2010;303(13):1295–302.
3. Institute of Medicine Committee on Advancing Pain Research Care, and Education. Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. In: *The National Academies Collection: Reports funded by National Institutes of Health*. Washington, DC: National Academies Press (US), National Academy of Sciences; 2011.
4. Deyo RA, Mirza SK, Martin BI. Back pain prevalence and visit rates: Estimates from U.S. national surveys, 2002. Spine 2006;31 (23):2724–7.
5. Goulet JL, Kerns RD, Bair M, et al. The musculoskeletal diagnosis cohort: Examining pain and pain care among veterans. Pain 2016;157(8):1696–703.
6. Haskell SG, Ning Y, Krebs E, et al. Prevalence of painful musculoskeletal conditions in female and male veterans in 7 years after return from deployment in Operation Enduring Freedom/ Operation Iraqi Freedom. Clin J Pain 2012;28(2):163–7.
7. Haskell SG, Mattocks K, Goulet JL, et al. The burden of illness in the first year home: Do male and female VA users differ in health conditions and healthcare utilization. Women's Health Issues 2011;21(1):92–7.
8. Higgins DM, Fenton BT, Driscoll MA, et al. Gender differences in demographic and clinical correlates among veterans with musculoskeletal disorders. Women's Health Issues– 2017;27 (4):463–70.
9. Haskell SG, Brandt C, Bastian L, Driscoll M, Bathulapalli H, Dziura J. Incident musculoskeletal conditions among men and women veterans returning from deployment. Med Care 2020;58 (12):1082–90.
10. Qaseem A, Wilt TJ, McLean RM, et al.; Clinical Guidelines Committee of the American College of Physicians. Noninvasive treatments for acute, subacute, and chronic low back pain: A clinical practice guideline from the American College of Physicians. Ann Intern Med 2017;166(7):514–30.
11. Buchbinder R, Underwood M, Hartvigsen J, Maher C. The Lancet Series call to action to reduce low value care for low back pain: An update. Pain 2020;161(Supplement 1):S57–S64.
12. Smith M, Davis M, Stano M, Whedon J. Aging baby boomers and the rising cost of chronic back pain: Secular trend analysis of longitudinal medical expenditures panel survey data for years 2000 to 2007. J Manipulative Physiol Ther 2013;36(1):2–11.
13. Becker A, Held H, Redaelli M, et al. Low back pain in primary care: Costs of care and prediction of future health care utilization. Spine 2010;35(18):1714–20.
14. Kim LH, Vail D, Azad TD, et al. Expenditures and health care utilization among adults with newly diagnosed low back and lower extremity pain. JAMA Netw Open 2019;2 (5):e193676.
15. Mehra M, Hill K, Nicholl D, Schadrack J. The burden of chronic low back pain with and without a neuropathic component: A healthcare resource use and cost analysis. J Med Econ 2012;15 (2):245–52.
16. Martin BI, Deyo RA, Mirza SK, et al. Expenditures and health status among adults with back and neck problems. JAMA 2008; 299(6):656–64.
17. Stevans JM, Delitto A, Khoja SS, et al. Risk factors associated with transition from acute to chronic low back pain in US patients seeking primary care. JAMA Netw Open 2021;4 (2):e2037371.
18. Higgins DM, Kerns RD, Brandt CA, et al. Persistent pain and comorbidity among Operation Enduring Freedom/Operation Iraqi Freedom/operation New Dawn veterans. Pain Med 2014;15 (5):782–90.
19. Mehling WE, Gopisetty V, Bartmess E, et al. The prognosis of acute low back pain in primary care in the United States: A 2-year prospective cohort study. Spine 2012;37(8):678–84.
20. Costa L. d C M, Maher CG, McAuley JH, et al. Prognosis for patients with chronic low back pain: Inception cohort study. BMJ 2009;339(oct06 2):b3829.
21. Viana MC, Lim CCW, Garcia Pereira F, et al. Previous mental disorders and subsequent onset of chronic back or neck pain: Findings from 19 countries. J Pain 2018;19(1):99–110.
22. Stewart WFY, Xiaowei B, Joseph A, et al. Patterns of health care utilization for low back pain. J Pain Res 2015;8:523–35.
23. Beyera GK, O'Brien J, Campbell S. Health-care utilisation for low back pain: A systematic review and meta-analysis of population-based observational studies. Rheumatol Int 2019;39 (10):1663–79.
24. Powell AC, Rogstad TL, Elliott SW, et al. Health care utilization and pain outcomes following early imaging for low back pain in older adults. J Am Board Fam Med 2019;32(6):773–80.
25. Higgins DM, Buta E, Heapy AA, et al. The relationship between body mass index and pain intensity among veterans with musculoskeletal disorders: Findings from the MSD Cohort Study. Pain Med 2020;21(10):2563–72.
26. Breland JY, Phibbs CS, Hoggatt KJ, et al. The obesity epidemic in the Veterans Health Administration: Prevalence among key populations of women and men veterans. J Gen Intern Med 2017;32(Suppl 1):11–7.
27. National Institutes of Health: National Heart Lung, and Blood Institute. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults–The evidence report. National Institutes of Health. Obes Res 1998;6(suppl 2): 51S–209S.
28. Shiri R, Karppinen J, Leino-Arjas P, Solovieva S, Viikari-Juntura E. The association between smoking and low back pain: A meta-analysis. Am J Med 2010;123(1):87.e7–87.35.
29. Zvolensky MJ, McMillan K, Gonzalez A, Asmundson GJ. Chronic pain and cigarette smoking and nicotine dependence among a representative sample of adults. Nicotine Tob Res 2009;11(12):1407–14.
30. Sinnott P, Wagner TH. Low back pain in VA users. Arch Intern Med 2009;169(14):1338–9; author reply 1339.

31. Sinnott PL, Siroka AM, Shane AC, Trafton JA, Wagner TH. Identifying neck and back pain in administrative data: Defining the right cohort. Spine 2012;37(10):860–74.
32. Farrar JT, Young JP Jr, LaMoreaux L, Werth JL, Poole RM. Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. Pain 2001;94 (2):149–58.
33. Kerns R, Wasse L, Ryan B, Drake A, Booss J. Pain as the 5th vital sign toolkit. Toolkit. Veterans Health Administration. 2019. Available at: https://www.va.gov/PAINMANAGEMENT/docs/Pain_As_the_5th_Vital_Sign_Toolkit.pdf (accessed July 16, 2021).
34. Jensen MP, Smith DG, Ehde DM, Robinsin LR. Pain site and the effects of amputation pain: Further clarification of the meaning of mild, moderate, and severe pain. Pain 2001;91 (3):317–22.
35. Serlin RC, Mendoza TR, Nakamura Y, Edwards KR, Cleeland CS. When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. Pain 1995;61(2):277–84.
36. Edelman EJ, Gordon K, Becker WC, et al. Receipt of opioid analgesics by HIV-infected and uninfected patients. J Gen Intern Med 2013;28(1):82–90.
37. Mannion AF, Wieser S, Elfering A. Association between beliefs and care-seeking behavior for low back pain. Spine 2013;38 (12):1016–25.
38. Maixner W, Fillingim RB, Williams DA, Smith SB, Slade GD. Overlapping chronic pain conditions: Implications for diagnosis and classification. J Pain 2016;17(9 Suppl):T93–t107.
39. Pangarkar SS, Kang DG, Sandbrink F, et al. VA/DoD clinical practice guideline: Diagnosis and treatment of low back pain. J Gen Intern Med 2019;34(11):2620–9.
40. Services USDoHaH. Pain Management Best Practices Inter-Agency Task Force Report: Updates, Gaps, Inconsistencies, and Recommendations. Available at: https://www.hhs.gov/ash/advisory-committees/pain/reports/index.html (accessed March 15, 2021),
41. Xu KY, Hartz SM, Borodovsky JT, Bierut LJ, Grucza RA. Association between benzodiazepine use with or without opioid use and all-cause mortality in the United States, 1999–2015. JAMA Netw Open 2020;3(12):e2028557.
42. Sun EC, Dixit A, Humphreys K, Darnall BD, Baker LC, Mackey S. Association between concurrent use of prescription opioids and benzodiazepines and overdose: Retrospective analysis. BMJ 2017;356:j760.
43. Tori ME, Larochelle MR, Naimi TS. Alcohol or benzodiazepine co-involvement with opioid overdose deaths in the United States, 1999–2017. JAMA Netw Open 2020;3(4):e202361.
44. Cote P, Baldwin ML, Johnson WG. Early patterns of care for occupational back pain. Spine 2005;30(5):581–7.
45. Carey TS, Evans AT, Hadler NM, et al. Acute severe low back pain. A population-based study of prevalence and care-seeking. Spine 1996;21(3):339–44.
46. Macfarlane GJ, Beasley M, Jones EA, et al. The prevalence and management of low back pain across adulthood: Results from a population-based cross-sectional study (the MUSICIAN study). Pain 2012;153(1):27–32.
47. IJzelenberg W, Burdorf A. Patterns of care for low back pain in a working population. Spine 2004;29(12):1362–8.
48. Angst F, Aeschlimann A, Angst J. The minimal clinically important difference raised the significance of outcome effects above the statistical level, with methodological implications for future studies. J Clin Epidemiol 2017;82:128–36.