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Short-term Variability in Outpatient Pain Intensity Scores in a National Sample of Older Veterans with Chronic Pain

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Abstract

Objective—The Department of Veterans Affairs (VA) uses the 11-point pain numeric rating scale (NRS) to gather pain intensity information from veterans at outpatient appointments. Yet, little is known about how NRS scores may vary over time within individuals; NRS variability may have important ramifications for treatment planning. Our main objective was to describe variability in NRS scores within a one-month timeframe, as obtained during routine outpatient care in older patients with chronic pain treated in VA hospitals. A secondary objective was to explore for patient characteristics associated with within-month NRS score variability.

Design—Retrospective cohort study.

Subjects—National sample of veterans 65 years or older seen in VA in 2010 who had multiple elevated NRS scores indicating chronic pain.

Methods—VA datasets were used to identify the sample and demographic and clinical variables including NRS scores. For the main analysis, we identified subjects with 2 or more NRS scores obtained in each of 2 or more months in a 12 month period; we examined ranges in NRS scores across the first 2 qualifying months.

Results—Among 4,336 individuals in the main analysis cohort, the mean and median of the average NRS score range across the two months were 2.7 and 2.5, respectively. In multivariable models, main significant predictors of within-month NRS score variability were baseline pain intensity, overall medical comorbidity, and being divorced/separated.

Conclusions—The majority of patients in the sample had clinically meaningful variation in pain scores within a given month. This finding highlights the need for clinicians and their patients to consider multiple NRS scores when making chronic pain treatment decisions.

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Disclosures

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Keywords

Chronic pain; Veterans; Numeric Rating Scale; Aged

Introduction

The prevalence of chronic non-cancer pain (CNCP) is estimated to be 10% to 20% in the general population (1,2). CNCP is especially common among veterans; up to half of veterans treated in Department of Veterans Affairs (VA) primary care settings have CNCP (3–6). Moreover, CNCP is associated with deficits in social function and well-being (7), increased morbidity and mortality (7), decreased satisfaction with healthcare (8), and increased healthcare utilization (9). Older adults are at high risk for pain problems—and pain treatment may be complicated by other chronic medical and psychiatric conditions (10), as well as the need to take multiple medications (11).

Since 1998, as one part of a national strategy to improve pain care ("Pain as the 5th Vital Sign" (12,13)), the VA has collected pain intensity score information from veterans as part of routine care during most outpatient clinical encounters; this information is available to clinicians in the electronic medical record and can be used to facilitate clinical decision-making about pain. These data also recently became available to researchers through VA's national Corporate Data Warehouse (CDW).

Specifically, veterans are administered the 11-point Numeric Rating Scale (NRS) (14). The version of the NRS used in the VA rates a patient's pain intensity as experienced "today" on a scale of 0 to 10, with 0 representing no pain and 10 representing worst possible pain. The NRS remains a standard for briefly measuring pain intensity and has been validated in a number of clinical contexts and patient populations (15,16). However, relatively little is known about how the NRS performs in clinical settings when administered by clinical personnel. Several investigations of VA patient populations (17–19) have shown that the accuracy of the NRS in measuring pain as administered during routine care is modest; problems with accuracy may largely reflect nurses' lack of adherence to administering standardized NRS items.

It is also unknown how NRS scores may vary over time. This information has potential clinical value. If variability over time is small, a single NRS score may be useful for understanding a patient's recent pain experience or response to a treatment change. Conversely, if NRS variability over time is large, single NRS values will have less clinical utility. Furthermore, some pain or comorbid conditions may be associated with more constant levels of pain intensity, while other conditions may be associated with more variable levels of pain intensity. Clinicians may benefit from awareness of relationships among patient or disease characteristics and pain intensity variability when making treatment decisions based on pain intensity scores.

In our review of the literature, we were able to identify only one study which found that fibromyalgia patients who had greater variability in pain scores were more likely to respond to placebo in a drug trial (20); we identified no published manuscripts describing how NRS

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scores may vary over time in routine practice. This is potentially important, as chronic pain guidelines recommend that clinicians systematically monitor response to treatment and make changes in opioid and other pain treatment based on treatment response (21–23). Such guidelines recommend monitoring outcomes every 3 to 6 months when regimens are stable, but more frequently when treatment changes are made. Yet, in current primary care practice, where most chronic pain care is provided, if a change is made in treatment, it is not likely that multiple measurements will be available before a subsequent treatment decision is required; clinicians may have only one score on hand to incorporate into clinical decision-making.

The primary objective of this project was therefore to describe variability in NRS scores as obtained during routine clinical care in an older patient population in the VA within a one-month period (defined here as *short-term variability*). A secondary objective was to explore for patient-related demographic and clinical characteristics that may be associated with short-term variability in NRS scores.

Materials and Methods

This study was reviewed and approved by the Institutional Review Board of the Veterans Affairs Medical Center (VAMC) where the study was conducted. The study was considered exempt from requiring informed consent as it was a secondary analysis of existing data contained in VA administrative datasets.

Sources of Data

In the VA, pain data are recorded as structured vital sign data in the electronic health record. These data are readily linked with outpatient and inpatient utilization, pharmacy, diagnosis, and demographic data available in VA's national CDW. The CDW is a rich, multilevel database that combines electronic health record data collected across 1,400 points of care for over 20 million veterans historically. VA researchers can access these data through the VA Informatics and Computing Infrastructure (VINCI). Within VINCI, project-specific databases are created and accessed using a suite of tools available to securely select, transform, and analyze data.

Sample

Our goal was to identify a national cohort of older (≥ age 65) veterans with indicators of chronic pain. A retrospective sample was obtained from the population of 5.9 million VA patients who had at least one ambulatory VA visit in 2010. Of these, 82% (4,834,884) had at least one NRS score recorded in the study year 2010. For each patient, all outpatient NRS scores available within a given month were averaged to produce a monthly pain score. If a given month included only one recorded pain score, this score was used as the respective monthly pain score for that patient. To be included in this study, we selected patients who had monthly pain scores from at least 3 different months within a 12-month period that were 4 or greater (defined as qualifying scores). Each candidate patient in the sample was assigned an index date, defined as the last day of the month in which the most recent qualifying monthly pain score was obtained.

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While there is no gold standard for identifying a chronic pain patient population using large datasets, our operational definition of chronic pain is consistent with commonly used definitions for chronic pain of moderate or greater intensity and our and other investigators' prior work using similar operational definitions for chronic pain (24–30). Use of similar methods facilitates potential comparisons across studies and populations. We chose a cutoff NRS score of 4 because of its consistency with VA clinical practice and policy regarding indication for further evaluation of pain; in addition, scores of 4 or greater are also indicative of moderate-to-severe pain (22,31,32). Finally, Tian et al (33) recently developed and validated an algorithm to identify chronic pain that combines pain intensity scores, International Classification of Diseases, Clinical Modification 9 (ICD-9-CM) diagnostic codes, and opioid prescription medications; in their analysis, addition of pain diagnoses resulted in 85% sensitivity and 98% specificity (ROC 0.98) using clinician documentation of pain condition as a standard. Therefore, we further refined our sample using ICD-9-CM diagnostic codes (Table 1) from outpatient and inpatient visits, selecting patients who had at least one pain diagnosis made by VA clinicians during the 12 months prior to the index date.

The current analysis is part of a larger research project in which we are seeking to understand associations between *incident* opioid use and pain scores over time. We thus excluded patients from our main cohort who had VA opioid prescriptions dispensed during the 12 months prior to the index date. We also excluded patients with documented ICD-9-CM cancer diagnoses in the 12 months prior to or after the index date—these diagnoses include malignant neoplasms, skin cancers, and carcinomas in situ: ICD-9-CM codes 140 through 208 and 230 through 239.2, inclusive. We also excluded patients who participated in a VA opioid substitution program in the 12 months prior to or following the index date and patients who died during the 12 months following the index date. After applying exclusion criteria, the final cohort included N=12,934 patients (Figure 1).

Measures

Dependent variables

Follow-up NRS scores over 12 months from index dates were obtained to examine short-term variability in outpatient NRS scores. Short-term variability was measured by averaging, for each individual, the within-month ranges of scores (for months with at least two scores). In order to ensure we had sufficient data (at least two measurements for each subject), for our primary analysis, we examined data from a subsample of veterans who had two or more months which each contained two or more scores; when there were more than two months with multiple scores, we examined only the first two months. We chose the first two scores in a given month because variability is sensitive to time, and the amount of time between scores might vary more when looking for highest scores.

Independent variables

Our independent variables were chosen based on prior research showing relationships among these variables and pain treatment or outcomes: pain and comorbid condition diagnoses and demographics have all been shown to predict pain prevalence and outcomes (34–41). As noted above, we were unable to identify prior studies examining associations

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among these variables and pain intensity *variability* in routine practice, but hypothesized we would detect such associations. Patient *demographic variables* included age (at index date), sex, race/ethnicity, marital status, and VA service-connected disability status. Ninety-three percent (12,043) of the cohort had at least one race designation on file. Asian, Pacific Islander, Native American, and other races represented cumulatively only 3% of the sample, so we collapsed these races into an "other" category. Available ethnicity categories included "not Hispanic or Latino," "Hispanic or Latino," "unknown," and "declined." We combined race and ethnicity to create 5 race/ethnicity categories: white (non-Hispanic), black (non-Hispanic), Hispanic/Latino, other (including multiple races), and unknown (including missing and declined).

Clinical variables included pain diagnoses obtained using ICD-9-CM codes recorded in the medical record in the 12 months prior to the index date (Table 1). Psychiatric diagnoses included major depression, schizophrenia, post-traumatic stress disorder (PTSD), panic or other anxiety disorder, substance use disorder including alcohol use disorder and nicotine use disorder. The baseline pain intensity score was defined as the average of all average monthly NRS pain scores beginning with the first qualifying monthly pain score and ending with the last qualifying monthly pain score prior to the index date. We measured overall medical comorbidity using the Selim index, which creates a score based on the presence of ICD-9-CM codes for 36 physical and mental conditions in the prior 12 months (42)(43). We also obtained counts of major surgeries to generate a dichotomous variable indicating whether a major surgery took place in the 12 months prior to the index date based on definitions from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP)(44).

Analysis

For the analyses, we excluded any pain scores that had been obtained during inpatient, residential, or nursing home stays and on the days of surgical and medical procedures. We also excluded scores taken on days with multiple pain scores. The rationale for these decisions was to remove scores reflecting particularly acute events so that the study would be focused on chronic pain. For example, multiple scores from an emergency department visit may be associated with acute injury or illness and with subsequent receipt of pain medications, and therefore may not be as representative of chronic pain.

The primary outcome for assessment of within-month variability was the average range of within-month pain scores, defined as high (>=2.5) vs. low (<2.5). Since the range is highly dependent on the number of scores available, our analyses fixed the amount of data used per individual. In particular, the main analysis used the first two scores within each of the first two months that had multiple scores to calculate an average within-month range. Because the distribution of the average NRS score range was highly skewed, we dichotomized at the median (2.5). We then used binomial regression (with log-link) to estimate the relative risk for having high within-month variability based on baseline pain score, age, sex, race/ethnicity, marital status, percent VA service-connected disability rating, Selim comorbidity score, occurrence of major surgery in previous year, nicotine or substance use disorder diagnosis in prior year, psychiatric disorder diagnoses (major depressive disorder,

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schizophrenia or bipolar disorder, post-traumatic stress disorder (PTSD), panic disorder or other anxiety disorder) in prior year, and pain diagnoses in prior year (Table 1). We collapsed Selim scores into 4 categories (0–5, 6–10, 11–15, 16–24) to reduce the impact of large Selim scores that were associated with relatively few individuals. We present relative risks for each predictor itself from univariable models as well as adjusted relative risks based on multivariable models containing all predictors. Sensitivity analyses were also conducted using the analogous outcome measure based on three months of data rather than two.

Results

Follow-up NRS pain scores were obtained for 12,934 individuals over the 12-month period following their index dates. On average, these patients had 5.4 months which included any pain scores. Of the 12,934 individuals, 4,912 (38%) did not have any months with multiple NRS scores in the follow-up period, 3,686 (28%) had exactly one month in which there were two or more scores, and 4,336 (34%) had two or more months which contained multiple pain scores; this latter group comprises our main study sample. Table 2 compares demographic and clinical characteristics of this latter group to the subjects who had been excluded from the sample due to having *fewer* than two months of multiple pain scores (N=8,598). We can see that patients in the main analysis subgroup (N=4,336) were more likely to be unmarried, have greater medical comorbidity, and to have had major surgery and more pain diagnoses given in the prior year versus the comparison group. Mean baseline pain score was slightly lower in the main study sample.

Figure 2 shows the distributions of the pain score ranges in the main study sample. For comparison we also examined the pain score ranges within the larger sample of all patients who had any months with two or more scores (N=8,022) (also Figure 2); in this latter case, we used all the scores obtained in months that had multiple scores. As can be seen, the two distributions are quite similar, but as expected, when we included more than 2 scores per month, the within-month ranges tend to be a little larger. In the main analysis, the mean and median of the pain score ranges (across 2 months), were 2.7 and 2.5, respectively.

We next examined potential predictors of within-month variability using the main study sample (N=4,336). Table 3 provides the unadjusted (univariable) and adjusted (multivariable) relative risks for high within-month variability based on demographic and clinical characteristics. In particular we found that black and Hispanic patients (compared to whites), divorced/separated patients (compared to married individuals), those with high Selim scores, and those with diagnosis of headache/migraine pain were more likely to have high short-term variability. Also, the greater a patient's baseline pain intensity, the greater the short-term variability in follow-up pain score.

For our planned sensitivity analysis, when restricting analyses to the 2,353 patients who had *three or more* months containing two or more scores, overall estimates remained similar, and marital status, Selim score and baseline NRS score remained significantly associated with greater within-month variability ($p=0.008$ for highest Selim category compared to lowest; $p=0.041$ for divorced/separated compared to married; and $p<0.001$ for baseline NRS

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score) (results not shown). However, in this model, race/ethnicity and headache/migraine pain diagnosis were no longer significant predictors of within-month pain score variability ($p \geq 0.233$ for each race category as compared to whites; $p=0.490$ for headache/migraine).

Discussion

To our knowledge, this study is the first to examine variability over time in pain intensity scores obtained during routine outpatient practice from a large national sample of patients. We found a median change in within-month pain score of 2. We also found that the main predictors of within-month variability in pain score were baseline level of pain intensity, overall medical comorbidity, and being divorced or separated. While black and Hispanic patients were more likely to have greater variability in scores in our main model, this difference became non-significant in our sensitivity analysis which incorporated three months of data rather than two.

In our main analysis, although approximately 30% of the months evaluated had within-month NRS ranges of 0, more than 50% of the months had ranges in NRS scores that were greater than 2. A change of 2 in NRS represents a 36% change based on a mean baseline score of 5.5 in the sample. Using varying reference standards, several studies (45,46) suggest that changes of 2 or of 30%, in NRS scores constitute clinically important changes. Thus, the majority of patients in the sample had clinically meaningful variation in pain scores within a given month. There are a number of potential sources for this variation including fluctuations in the intensity of pain or the conditions contributing to pain, application of new interventions for pain, or factors related to NRS administration (18,47). While our study findings support the potential for NRS scores from routine practice to be useful for understanding pain outcomes, the results suggest that synthesis of NRS scores obtained over multiple time points is indicated when NRS scores are to be used in clinical decision-making or as outcomes in research.

The results specifically highlight the need for clinicians to keep in mind that short-term fluctuations in pain intensity in ambulatory patients are likely to be common, and that they should avoiding making chronic pain treatment decisions based on scores obtained from single visits. Furthermore, providing basic education to chronic pain patients that the severity of their pain is expected to fluctuate, and discussing with them that measuring pain intensity over time, and in the context of what is perhaps a usual level of pain intensity for the patient, may be more useful for clinical decision making (48).

Our results further support that pain intensity may not be a particularly useful measure by itself or for monitoring outcomes of chronic pain treatment in outpatient settings. VA's Pain as the 5th Vital Sign initiative was initially conceived primarily as a mechanism for screening patients for unidentified, unrelieved pain (12), not as a treatment monitoring mechanism. Indeed, measures of function are highly recommended for monitoring outcomes over time and for guiding treatment of chronic pain (48). Unfortunately, functional measures are not currently available in national VA datasets. Incorporation of systematically-obtained, serial, patient-reported measures of pain (intensity and function) into routine care in a way

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that can facilitate decision-making based on data from multiple time points is clearly indicated.

Our study results identified certain demographic and clinical factors that predict greater variability in pain NRS scores. These include higher baseline pain intensity, race/ethnicity, marital status, medical comorbidity, and diagnosis of headache/migraine. Several studies have demonstrated race/ethnicity differences and disparities in screening, ratings of pain, and treatment of pain (49–52). However we note that race/ethnicity was not significantly associated with NRS variability in our planned sensitivity analysis which examined variability using three months of data. Here, we suggest that some factors (e.g., multiple treatment changes or disease progression) may have a greater influence on NRS scores when examining NRS scores over longer time frames. Clearly more research is needed in this particular area.

While we detected significant relationships between certain variables and short-term variability in NRS scores, we note that the magnitude of the differences we found were fairly small—in the 10% range; to what extent these differences may be meaningful in practice is debatable. The variable demonstrating the greatest increase (17%) in probability of greater variability was overall medical comorbidity—this suggests perhaps that comorbid medical conditions may contribute substantively to the experience of pain intensity. Somewhat contrary to our expectations, mental health diagnoses were not associated with increased variability; prior research has demonstrated that mental health comorbidity is associated with worse pain outcomes as well as propensity to be prescribed opioids (53,54). Taken together with our findings, this research suggests that the factors that predict short-term variability in pain intensity may be different than the factors that affect overall pain prognosis, and that the factors that may most strongly predict short-term variability may not be captured in administrative healthcare datasets.

There are a number of important limitations to this study—the first regards generalizability of our findings. For this study's main analysis, the sample was restricted to those patients who were seen frequently enough to have multiple pain intensity scores obtained in two or more months. As can be seen in Table 2, there were differences when comparing these patients to patients less frequently administered the NRS. In post-hoc analyses, we examined clinical and demographic characteristics when comparing our main study sample to patients who had been excluded from the overall cohort due to having been prescribed an opioid in the year prior to the index date and to those excluded due to cancer. In these comparisons (results not shown), there were few meaningful differences seen aside from a higher prevalence of major surgery in the year prior to index dates in the prior opioid subgroup and the cancer subgroup, and a higher prevalence of back pain in the prior opioid subgroup. Overall, these comparisons suggest that in many ways our main study sample was representative of the larger group of older patients with chronic pain treated in VA, but that frequency of administration of NRS scores (likely reflecting morbidity and care utilization) and prior major surgery may have impacts on short-term variability in NRS scores that our study did not detect.

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There are additional limitations: Although we used methods similar to those of prior studies, there is no gold standard for identifying a chronic pain patient population using a large administrative dataset. We also note that we were not able to account for the impact of new pain treatments that may have been initiated between subjects' first and second pain scores. Our sensitivity analysis did attempt to account for effects of differences in how we defined the study period, and did show somewhat different results. This finding suggests that variability in pain intensity scores may change over time within individuals. Further examination of this result would be important, but was beyond the scope of this study. Although researchers have examined validity and reliability of NRS in a number of patient populations, we had no way of ascertaining to what extent cognitive characteristics of patients or characteristics of administering NRS to this older patient population may have influenced the NRS data obtained. Finally, in our models, we had limited data available from VA administrative datasets to explore for correlates of variability.

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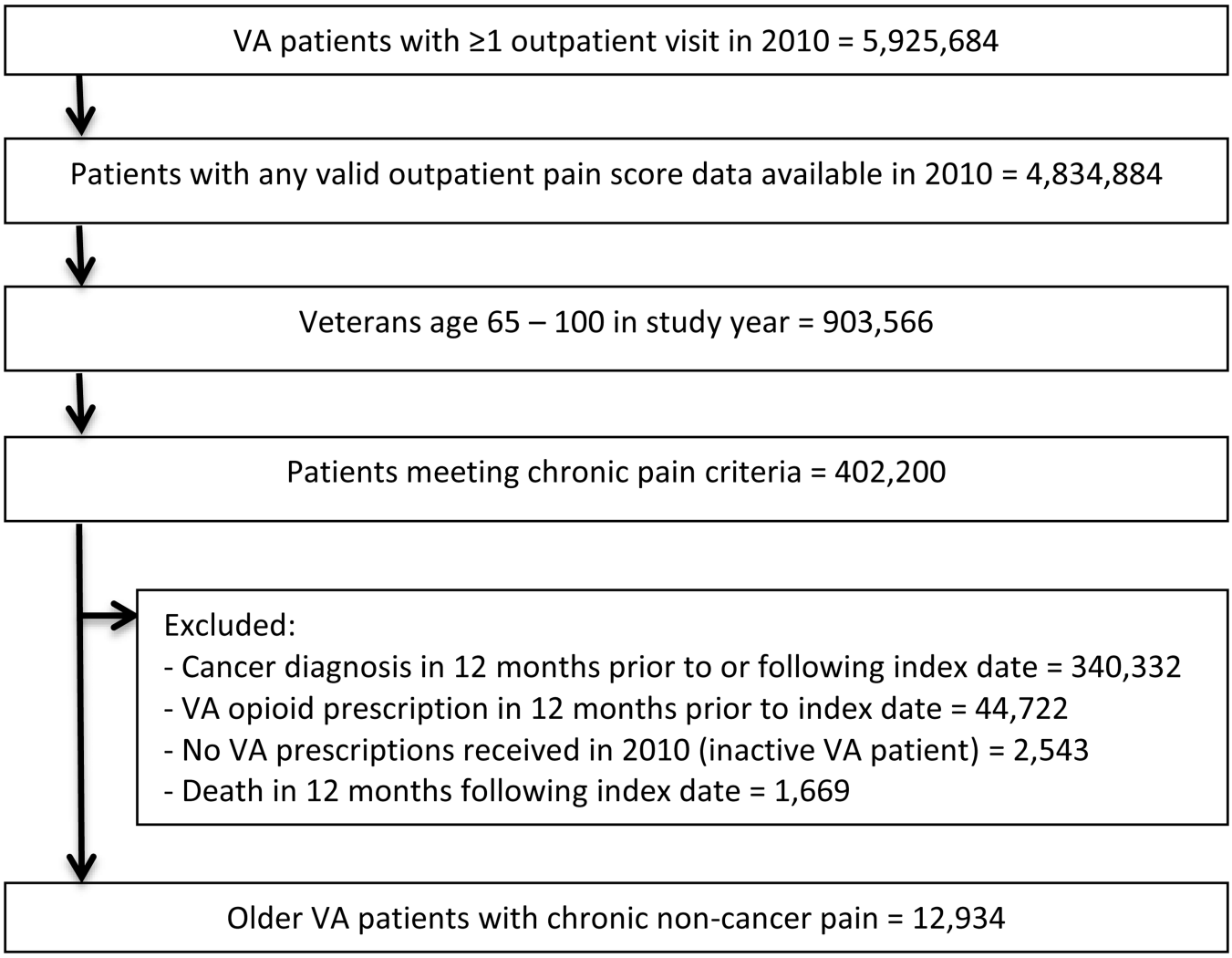

Figure 1.
Study flowchart

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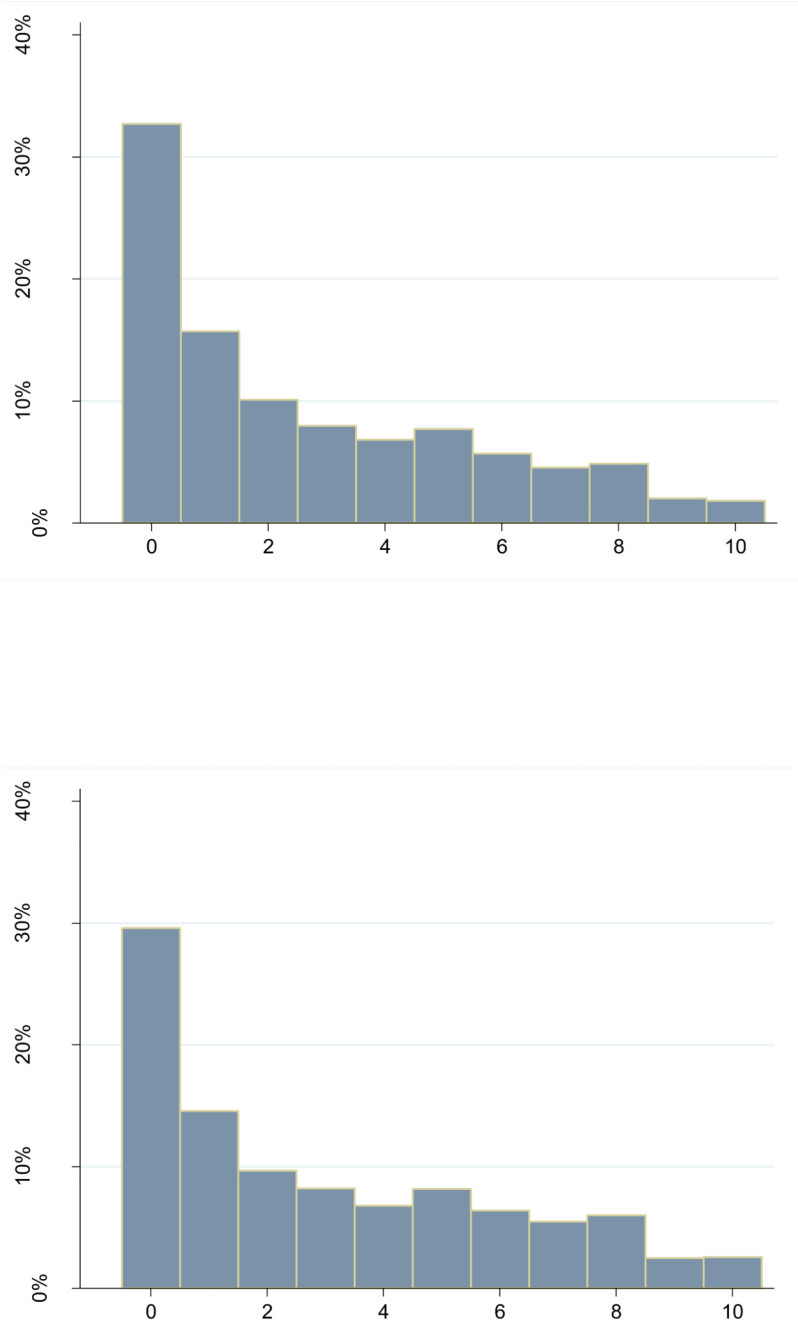

Figure 2.

Distributions of monthly pain score ranges

Range of first 2 NRS scores within first 2 months for 4,366 individuals who had 2 or more scores in 2 or more months (main analysis sample)

Range in all NRS scores within all months for 8,022 individuals who had 2 or more scores in any month

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Table 1

International Classification of Diseases, ninth edition, clinical modification (ICD-9-CM) codes used to identify pain and psychiatric diagnoses

Pain	Chronic neck/joint pain	716 – 719.99; 723 – 723.99; 729 – 729.09; 729.2 – 729.99
	Rheumatism/Arthritis/Gout	274 – 274.99; 712 – 712.99; 714 – 716.99; 720 – 720.99; 729 – 729.09; 729.20 – 729.99
	Fibromyalgia	729.1
	Chronic low back pain	722 – 722.99; 724 – 724.99
	Neuropathies[1]	250.6 – 256.69; 337.0 – 337.19; 354 – 354.99; 356 – 357.99; 377 – 377.99
	Headache/Migraine	346.9 – 349.99; 784.0
	Inflammatory bowel disease	558.9
	Other musculoskeletal pain	710 – 711.99; 713 – 713.99; 721 – 721.99; 725 – 728.99; 730 – 739.99

[1] Includes diabetic neuropathy and carpal tunnel syndrome

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Table 2

Characteristics of VA patients with CNCP, comparing short-term variability subgroup to patients not included in short-term variability subgroup

	Short-term variability subgroup (N=4,336)*	Not in short-term variability subgroup (N=8,598)**	p-value
Demographic characteristics			
Age (years):Mean(SD)	73.51 (7.42)	72.93 (7.13)	<0.001
Sex: Male	4,154 (95.80)	8,319 (96.76)	0.006
Race/Ethnicity			<0.001
White(non-Hispanic)	2,799 (64.55)	5,687 (66.14)	
Black(non-Hispanic)	862 (19.88)	1,435 (16.69)	
Hispanic	272 (6.27)	484(5.63)	
Other	188 (4.34)	411 (4.78)	
Unknown	215 (4.96)	581 (6.76)	
Marital status			<0.001
Married	2,280 (52.58)	5,126 (59.62)	
Divorced/Separated	1,153 (26.59)	1,995 (23.20)	
Single/Never Married	268 (6.18)	422 (4.91)	
Widowed	635 (14.64)	1,055 (12.27)	
Percent service-connected disability			<0.001
Not service-connected	1,731 (39.92)	3,430 (39.89)	
Less than 50%	551 (12.71)	1,303 (15.15)	
50% or more	2,054 (47.37)	3,865 (44.95)	
Clinical characteristics (12 months prior to index date):			
Baseline pain intensity***: Mean(SD)	5.34 (1.61)	5.71 (1.57)	<0.001
Selim comorbidity index score			<0.001
0–5	1,130 (26.06)	3,785 (44.02)	
6–10	2,098 (48.39)	3,933 (45.74)	
11–15	851 (19.63)	761 (8.85)	
16–24	257 (5.93)	119 (1.38)	
Major surgery	147 (3.39)	189 (2.20)	<0.001
Any Mental health diagnosis****	1,904 (43.91)	3,357 (39.04)	<0.001
Nicotine or substance use disorder	739 (17.04)	1,402 (16.31)	0.287
Pain diagnoses			
Chronic neck/joint pain	2,763 (63.72)	5,114 (59.48)	<0.001
Rheumatism/Arthritis/Gout	2,905 (67.00)	5,537 (64.40)	0.003
Fibromyalgia	198 (4.57)	306 (3.56)	0.005
Chronic lower back pain	2,026 (46.73)	3,974 (46.22)	0.587
Neuropathies	1,228 (28.32)	1,960 (22.80)	<0.001
Headache/Migraine	363 (8.37)	614 (7.14)	0.012
Other musculoskeletal pain	2,082 (48.02)	3,535 (41.11)	<0.001

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* Short term variability subgroup = main study sample: Patients with two or more months which contained multiple numeric rating scale (NRS) pain intensity scores

** Not in short term variability subgroup: Patients who had less than two months during the follow-up period in which there were two or more scores

*** Baseline pain intensity score is average of all monthly NRS pain scores beginning with first qualifying monthly pain score and ending with last qualifying monthly pain score prior to the index date.

**** Includes major depression, anxiety disorder, PTSD, bipolar disorder or schizophrenia

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Table 3

Univariable and Multivariable models of short term variability subjects, N=4,336 [Outcome = Range of first two scores in first 2 months greater than 2.5 (median). Low group: 0–2, High group: 2.5–10]

	Univariable Risk Ratio (95% CI)	p-value	Multivariable Risk Ratio (95% CI)	p-value
Demographic characteristics				
Age (years): Mean(SD)	1.00 (1.00, 1.00)	0.533	1.00 (1.00, 1.01)	0.599
Sex				
Male	0.94 (0.83, 1.07)	0.367	0.96 (0.84, 1.10)	0.548
Female	*Reference*		*Reference*	
Race/Ethnicity		0.005		0.006
White, non-Hispanic	*Reference*		*Reference*	
Black, non-Hispanic	1.12 (1.04, 1.20)	0.001	1.11 (1.04, 1.19)	0.003
Hispanic	1.13 (1.02, 1.26)	0.024	1.14 (1.03, 1.27)	0.014
Other	1.08 (0.95, 1.23)	0.251	1.10 (0.96, 1.25)	0.160
Unknown	0.97 (0.85, 1.12)	0.683	0.98 (0.85, 1.13)	0.783
Marital status		0.045		0.057
Married	*Reference*		*Reference*	
Divorced/Separated	1.09 (1.02, 1.17)	0.007	1.10 (1.03, 1.17)	0.007
Single/Never Married	1.04 (0.93, 1.17)	0.479	1.04 (0.92, 1.18)	0.497
Widowed	1.07 (0.99, 1.16)	0.098	1.05 (0.97, 1.15)	0.223
Percent service-connected disability rating		0.835		0.406
Not service-connected	*Reference*		*Reference*	
Less than 50%	1.01 (0.92, 1.10)	0.857	1.01 (0.93, 1.11)	0.792
50% or more	1.02 (0.96, 1.08)	0.548	1.04 (0.98, 1.11)	0.186
Clinical characteristics: 12 months prior to index date				
Baseline average NRS: Mean*	1.02 (1.00, 1.04)	0.028	1.02 (1.00, 1.04)	0.011
Selim comorbidity index score		0.001		0.002
0–5	*Reference*		*Reference*	
6–10	0.96 (0.90, 1.03)	0.231	0.96 (0.89, 1.03)	0.211
11–15	1.02 (0.94, 1.10)	0.682	1.01 (0.93, 1.10)	0.801
16–24	1.19 (1.07, 1.32)	0.002	1.17 (1.04, 1.31)	0.007
Major surgery	1.07 (0.93, 1.24)	0.340	1.08 (0.93, 1.24)	0.304
Any Mental health diagnosis**	1.01 (0.95, 1.07)	0.779	1.00 (0.94, 1.06)	0.931
Substance use disorder including nicotine	1.00 (0.93, 1.08)	0.929	0.99 (0.92, 1.07)	0.870
Pain diagnoses				
Chronic neck/joint pain	1.06 (1.00, 1.12)	0.064	1.02 (0.96, 1.09)	0.447
Rheumatism/Arthritis/Gout	1.06 (0.99, 1.12)	0.076	1.05 (0.98, 1.11)	0.151
Fibromyalgia	1.05 (0.93, 1.19)	0.436	1.05 (0.93, 1.20)	0.415
Chronic lower back pain	0.96 (0.91, 1.01)	0.134	0.95 (0.90, 1.01)	0.101
Neuropathies	1.03 (0.96, 1.09)	0.422	1.03 (0.96, 1.09)	0.431
Headache/Migraine	1.10 (1.01, 1.21)	0.037	1.11 (1.01, 1.21)	0.030

	Univariable Risk Ratio (95% CI)	p-value	Multivariable Risk Ratio (95% CI)	p-value
Other musculoskeletal pain	1.04 (0.98, 1.10)	0.171	1.03 (0.97, 1.09)	0.382

* For every 1 unit increase in baseline NRS, the estimated increase in risk of having high short-term pain score variability is 2%

** Includes Major Depression, Anxiety, PTSD, Bipolar or Schizophrenia

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