HHS Public Access

Author manuscript

J Pain. Author manuscript; available in PMC 2020 December 01.

Published in final edited form as:

J Pain. 2019 December ; 20(12): 1429–1445. doi:10.1016/j.jpain.2019.05.006.

Development and Assessment of a Crosswalk Between ICD-9-CM and ICD-10-CM to Identify Patients with Common Pain Conditions

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Abstract

Effective management of patients with pain requires accurate information about the prevalence, outcomes, and co-occurrence of common pain conditions. However, the transition from ICD-9-CM to ICD-10-CM diagnostic coding in 2015 left researchers without methods for comparing the prevalence of pain conditions before and after the transition. In this study, we developed and assessed a diagnostic framework to serve as a crosswalk between ICD-9-CM and ICD-10-CM diagnosis codes for common pain-related health conditions. We refined existing ICD-9-CM definitions for diagnostic clusters of common pain conditions consistent with the US National Pain Strategy and developed corresponding ICD-10-CM definitions. We then assessed the stability of prevalence estimates and associated patient socio-demographic features of each diagnostic cluster during one-year periods before and after the transition to ICD-10-CM in three US health care systems using electronic health records data for in-person encounters. Prevalence estimates and socio-demographic characteristics were similar before and after the transition. The Pain Condition ICD-9-CM to ICD-10-CM Crosswalk includes a full spectrum of common pain conditions to enable prevalence estimates of multiple and chronic overlapping pain conditions. This allows the tool to serve as a foundation for a broad array of pain-related health services research utilizing electronic databases.

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Disclosures.

No conflicts of interest exist for the authors of this manuscript.

Keywords

Pain; epidemiology; health services research; prevalence; electronic databases

Introduction.

Pain is a significant public health problem affecting approximately 20% of adults in the United States (US).[3, 10, 13] However, specific data are lacking on the incidence, prevalence, and outcomes of most common pain conditions. Health services research on chronic pain has typically focused on single pain conditions, such as low back pain or headache, despite an increasing recognition of multiple chronic overlapping pain conditions.[12] Focusing on single pain conditions can limit understanding of the effects of chronic pain, as those who are most disabled by chronic pain and use the most health care services typically suffer from multiple pain conditions.[2, 13] The US National Pain Strategy (NPS), released in 2016, called for action to improve population research methods for pain, citing the opportunity presented by increasing availability of large electronic health care databases to determine the prevalence of common pain conditions and gain new insights about how these conditions are typically treated.[11]

To conduct effective electronic health records (EHR) research on patients with common pain conditions, researchers need to identify these patients in a comprehensive manner that is consistent over time. Because chronic pain can be caused by many different underlying conditions, the International Classification of Diseases (ICD) diagnoses that correspond to a chronic pain condition are inexact and difficult to identify. For example, low back pain is a common chronic pain condition, yet approximately 66 different ICD, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic codes correspond to causes of mechanical low back pain, and only a few include “pain” or “ache” in the description.[1] While addressing this issue is a significant focus in the development of ICD-11, this updated diagnostic classification system will not be adopted for several years.[19] Current pain-related health services research in the depends on the ICD-9-CM system, which was in use from 1979 to 2015, and ICD-10-CM, which has been in use since 2015. These classification systems are used in most venues of health care to report diagnoses in the US.

To facilitate population-based pain research, Von Korff and colleagues (2016) identified 11 diagnostic clusters and their corresponding ICD-9-CM diagnostic codes [20], drawing on the guidelines identified by the US NPS and its Population Research Workgroup. [11] However, authors of this work recognized that the diagnostic clusters may require further refinement before adoption as a framework for research.[20] Tian and colleagues (2013) proposed methods for using ICD-9-CM codes in combination with other EHR data to identify patients with chronic pain.[18] Thus while preliminary research has been done, there are not current research standards for identifying persons receiving care for the spectrum of common pain conditions. Further, existing frameworks have focused on ICD-9-CM codes: with the US’ implementation of ICD-10-CM in October 2015, which introduced more than 50,000 new diagnostic codes, prior work on ascertaining pain conditions using diagnostic codes needs to be updated.[15] A diagnostic framework that consistently identifies pain conditions across the

ICD-9-CM to ICD-10-CM transition could be used as a standardized tool for a variety of research endeavors, including health services and epidemiologic research.

To address these problems, we refined the provisional ICD-9-CM diagnostic codes to identify pain-related diagnostic clusters recently published by Von Korff et al. (2016).[20] We focused on ensuring that the range of conditions commonly contributing to acute and chronic pain were represented and the groupings of diagnoses enable researchers to differentiate conditions. Then, we identified corresponding ICD-10-CM diagnostic codes. We evaluated the resulting crosswalk by assessing the stability of prevalence estimates of the diagnostic clusters across the ICD-9-CM to ICD-10-CM transition, along with corresponding patient socio-demographic correlates, in three distinct health care systems.

Methods

Developing and refining the ICD-9-CM codes

To create a comprehensive list of ICD-9-CM codes for common pain conditions, we combined several existing frameworks. First, we reviewed diagnostic codes for 11 pain-related diagnostic clusters developed by Von Korff and colleagues (2016). These clusters and associated codes, which followed the diagnostic clusters for population pain research specified in the US NPS, included back pain; neck pain; limb/extremity pain, arthritis disorders (including osteoarthritis and joint pain); fibromyalgia and widespread muscle pain; headache; orofacial, ear and temporomandibular pain; abdominal pain and bowel pain; urogenital, pelvic and menstrual pain; chest pain; fractures, contusions, sprains and strains; and other painful conditions.[20] The codes were specified based on the American Pain Society Taxonomy [5] and classifications developed by Health Care System Research Network investigators,[16] VHA researchers,[7, 9] and diagnostic clusters in the Ambulatory Care Group System.[17, 21] Next, we merged these codes with a list of pain-related diagnostic codes developed by DeBar and Deyo for a National Institutes of Health (NIH) Collaboratory pragmatic clinical trial to identify potentially eligible patients with chronic or persistent pain.[4] Thus, conditions typically associated with acute pain, such as fractures and contusions, were not included in the list created for the NIH Collaboratory trial. Since the trial was conducted from 2014 to 2018 this list included a completed crosswalk with both ICD-9-CM and ICD-10-CM diagnoses codes. Finally, we compared this merged list of ICD-9-CM diagnostic codes to a list of chronic pain codes developed by Tian and colleagues to identify patients with chronic pain from EHR data. Our merged list included all codes mentioned by Tian et al.,[18] so no additional codes were added.

We then reviewed the combined list of ICD-9-CM codes in conjunction with the diagnostic cluster framework specified by the US NPS to ensure that: the codes for conditions included were generally associated with pain; the range of chronic pain conditions included was comprehensive and reflected those which are most common; and, the codes were organized into clusters and subcategories so that pain conditions which are more often chronic could be differentiated from conditions typically associated with acute pain. This review was conducted by a subset of the authors (MM, RAD, MVK) and final adjudications related to the removal of codes was done by the clinician reviewer (RAD). Based on our review, multiple diagnoses related to deformities, many of which are not typically associated with

pain, were identified and removed. In addition, a small number of diagnostic codes for conditions that are extremely rare were eliminated (e.g., Kaschin-Beck disease) since they are not common conditions associated with pain. Lastly, the combined list contained many diagnoses for fractures, contusions, sprains and strains which are typically associated with acute pain. We retained this cluster but did not do further work to identify additional common acute causes of pain to include in our framework; those included are based on prior work done by the US NPS Population Workgroup and published by Von Korff et al.[20]

Identifying the ICD-10-CM codes

After creating a comprehensive list of ICD-9-CM pain-related diagnostic clusters and the associated codes, we next sought to identify the corresponding ICD-10-CM codes for each. First, we accessed the 2017 Centers for Medicare & Medicaid Services (CMS) General Equivalence Mappings (GEM) crosswalk, and linked each code in our final list of ICD-9-CM pain codes to the ICD-10-CM codes (forward mapping) using this crosswalk.[6, 14] ICD-10-CM introduced increased specificity by adding body location-specific codes. However, when we conducted this forward mapping, only the most general code (usually "unspecified" location) was linked; as other researchers have noted, the majority (75%) of ICD-10-CM codes are not represented in the forward map.[6] Because the ICD-9-CM codes in our list had undergone extensive review, we did not conduct forward backward mapping since we expected it to result in the addition of secondary ICD-9-CM codes and ICD-10-CM targets that would be unrelated to the ICD-9-CM source code.[6] Therefore, using our ICD-9-CM list and these initial ICD-10-CM codes identified from the forward mapping as a guide, we conducted a complete review of the ICD-10-CM diagnostic code list in order to add other codes that were consistent with the ICD-9-CM codes (MM, RAD). This consisted of 1) comparing the descriptions and categories of ICD-9-CM codes in our list against the categories and descriptions of ICD-10-CM codes to make sure that relevant codes from ICD-10-CM were included and 2) using the general codes identified in our ICD-10-CM forward mapping as a guide, reviewing the specific codes and conditions within the category to determine if they should be included. Finally, using a second ICD-9-CM to ICD-10-CM crosswalk issued by the National Committee for Quality Assurance (NCQA), we conducted forward mapping of each ICD-9-CM code on our list and added any additional ICD-10-CM codes that we had not yet included (MM, MVK).

Assessing consistency across the ICD-9 to ICD-10 transition

To determine the consistency of the crosswalk between ICD-9-CM and ICD-10-CM, we applied it to populations of patients served by three different health care systems during two year-long time periods: one when ICD-9-CM was in use and one when ICD-10-CM was in use. The three distinct US health care systems included were: 1) Kaiser Permanente Northwest (KPNW), 2) Group Health Cooperative of Puget Sound (GHC), (which became Kaiser Permanente Washington (KPWA) in January 2017), and 3) Veterans Health Administration (VHA), which are described further below. Each of these health care systems uses an integrated EHR that provides a record of inpatient and outpatient health care encounters including patient demographics, diagnoses, clinic visits, prescriptions, and other health care services. Three different health care systems were included in this study as they

provided the opportunity to assess the crosswalk's consistency in multiple populations and health care settings.

Study populations and settings—Within each health system, we included all patients who were age 18 and older and completed an in-person health encounter (inpatient or outpatient) during one or both of the following time periods: 1) 10/1/14 to 09/30/15 and 2) 1/1/16 to 12/31/16. The first time period is the 12 months prior to implementation of ICD-10-CM in the US. For the period when ICD-10-CM was in use, we allowed for a 3-month transition period between ICD-9-CM and ICD-10-CM, which we did not assess, and focused on the 12-month period following this transition. We allowed for the 3-month transition period based on analyses conducted by both Kaiser Permanente regions that indicated that ICD-9-CM codes were still frequently used during the 3-month transition but stopped after December 2015. In VHA the ICD-9-CM codes could not be used after Sept. 30, 2015, however the same 3-month exclusion period was applied.

In 2016, KPNW provided health insurance and medical care for approximately 606,000 members in northwest Oregon and southwest Washington, representing about 24% of the area's population. There were 351,778 KPNW members who met inclusion criteria for the ICD-9-CM period and 368,947 who met criteria for the ICD-10-CM time period, representing 450,129 unique individuals. Of these, 270,595 (60%) individuals had at least one in-person encounter during both the ICD-9-CM and ICD-10-CM periods. For both the ICD-9-CM and ICD-10-CM periods included in this study, the mean age of the KPNW population was 49 years and 56% of the population was female. The racial and ethnic composition of the KPNW populations for the two time periods was also similar with 81% of the population describing themselves as White, 3% Black or African American and 16% as other; in addition, 7% of the population reported being of Hispanic ethnicity.

In 2016, GHC provided medical coverage and care to more than 600,000 members in Washington state and Northern Idaho. There were 286,861 medical plan members who met inclusion criteria for the ICD-9-CM period and 261,972 for the ICD-10-CM period; across the two time periods we included a total of 346,056 unique individuals, and 202,777 (58.6%) of these had at least one visit during both periods. For the two time periods included in this study, the mean age of the GHC population was 51 and 52 years respectively and during both periods 58% of the population was female. The racial and ethnic composition of the GHC populations for the two time periods was also similar with 74% of the population describing themselves as White, 5% Black or African American and 21% as other; in addition, 5% of the population reported being of Hispanic ethnicity.

For this study, we limited eligibility to VHA patients who served in support of Operation Enduring Freedom, Operation Iraqi Freedom and Operation New Dawn (OEF/OIF/OND). This nationally distributed cohort of VHA patients was used for this study because the OEF/OIF/OND veterans are younger and include a larger proportion of women and racial and ethnic minorities than all veteran users of VHA. The study population was identified by using the VA National OEF/OIF/OND Roster, an accruing database of veterans whose military service began after or extended beyond October 1, 2001 and have enrolled in VHA.[8] Despite the focus on OEF/OIF/OND veterans, there are significant overall differences

between the populations served by KPNW and GHC and the VHA population we studied: the latter includes a larger proportion of non-White and male patients. There were 515,541 VHA veterans who met the inclusion criteria, described above, for the ICD-9-CM period and 563,426 for the ICD-10-CM period; across the two time periods we included a total of 645,819 unique individuals and, of these, 433,072 individuals (67%) had at least one visit in both periods. For the ICD-9-CM and ICD-10-CM periods included in this study, the mean age of the VHA population was 38 and 39 years respectively and only 13% of the population was female. The racial and ethnic composition of the VHA populations for the two time periods was also similar with 62–63% of the population describing themselves as White, 16% Black or African American and 21% as other; in addition, 11% of the population reported being of Hispanic ethnicity.

The Institutional Review Boards (IRB) of KPNW, serving as IRB of record for KPNW and KPWA (formerly Group Health), and VA Connecticut Healthcare System and Yale School of Medicine approved this study. The Institutional Review Boards (IRB) of KPNW, serving as IRB of record for KPNW and KPWA (formerly Group Health), and VA Connecticut Healthcare System and Yale School of Medicine approved this study. A waiver of informed consent was obtained for this study.

Assessment methods—To evaluate the performance of the crosswalk, we assessed the following within our eligible sample for each health care system for the two time periods of interest. All diagnostic codes associated with an in-person outpatient or inpatient encounter were assessed.

- Percent of individuals in the sample for each time period with a pain-related ICD-9-CM or ICD-10-CM diagnostic code in each cluster.
- Percent of encounters (in-person outpatient or inpatient) completed by individuals in the sample for each time period that involved a pain-related ICD-9-CM or ICD-10-CM code in each cluster.
- Percentage of individuals in the sample with at least one in-person encounter in both time periods that involved a pain-related ICD-9-CM or ICD-10-CM code by age, sex, race and ethnicity in each cluster.

We assumed that there would be no major change in the percent of the adult population and the percent of visits that involved pain-related diagnoses should be relatively stable from the first time period to the second. Thus, we expected that, if the refined crosswalk were successfully identifying similar patients with ICD-9-CM and ICD-10-CM diagnoses, these percentages would be similar in both time periods within each health care system. Therefore, we compared the observed frequencies for the ICD-9-CM and ICD-10-CM periods to identify any discrepancies that might suggest missing or erratic codes in our crosswalk. We also expected that if the crosswalk consistently identified individuals who received care for a diagnosis within one of the pain-related diagnostic clusters, then the socio-demographic characteristics of the individuals within each cluster would be similar across the ICD-9-CM and ICD-10-CM time periods. To assess this, we compared the percentage of individuals with at least one in-person encounter in both time periods who were associated with each pain-related diagnostic cluster by age, sex, race and ethnicity within each health system.

Statistical analyses of these comparisons were not conducted because the very large sample size for this study would likely result in any difference being statistically significant but not epidemiologically or clinically relevant. However, we did assess the absolute difference and the relative difference (as percent change) in prevalence from the ICD-9-CM to the ICD-10-CM periods for the percent of the adult population by pain condition cluster. This assessment was limited to clusters in which the total number of individuals exceeded 1,000; clusters with a population fewer than 1,000 were not assessed since minor discrepancies in the absolute values would greatly affect the relative differences. A percent change greater than 20% was set as the threshold for further inquiry and any relative differences by pain condition cluster which were exhibited in more than one health care system would require assessment and, if needed, resolution. This threshold was selected based on prior work by Yoon and Chow assessing chronic disease prevalence rates among 34 conditions across the transition to ICD-10.[22] The authors employed a different analytic approach, but any significant changes they identified were associated with a greater than 20% change in overall rate. Relative differences were not assessed for the percent of encounters by cluster since we would expect fluctuations in encounters due to the difference in calendar periods assessed (i.e., 12-month period spanning two calendar years vs. one calendar year). However, relative differences were also assessed for the socio-demographic population characteristics of each cluster across the ICD-9-CM and ICD-10-CM time periods.

Results.

Refined crosswalk framework

The refined set of pain-related diagnostic clusters included in the resulting ICD-9-CM to ICD-10-CM Crosswalk (with subcategories within clusters) is summarized in Table 1. The crosswalk includes 13 pain-related diagnostic clusters: 12 which are often associated with chronic pain conditions, and one cluster that is generally associated with acute pain conditions. The chronic pain diagnostic clusters include: 1) back pain, 2) neck pain, 3) limb/extremity pain, joint pain and non-systemic, non-inflammatory arthritic disorders 4) fibromyalgia, 5) headache, 6) orofacial, ear, and temporomandibular disorder pain, 7) abdominal and bowel pain, 8) urogenital, pelvic, and menstrual pain, 9) musculoskeletal chest pain, 10) neuropathy, 11) systemic disorders or diseases causing pain and 12) other painful conditions. The generally acute pain cluster is: 13) fractures, contusions, sprains and strains. The complete Pain Condition ICD-9-CM to ICD-10-CM Crosswalk, available as a SAS dataset for use in programming, can be accessed on GitHub, a publicly accessible site (https://github.com/PainResearch/PainCondition_ICD9CM_ICD10CM_Crosswalk). Subsequent revisions of the crosswalk will be available at the GitHub site, and general information about the Pain Condition ICD-9-CM to ICD-10-CM Crosswalk and any updates can be accessed there.

Our Pain Condition ICD-9-CM to ICD-10-CM Crosswalk diagnostic clusters differ from the clusters for population pain research proposed by the US NPS in the following ways. First, we added subcategories to most clusters to aid in identifying associated conditions within a cluster. The US NPS cluster “fibromyalgia and widespread muscle pain” was revised to only include codes for fibromyalgia. Codes associated with widespread muscle pain were moved

to a subcategory of “general pain” under the cluster “other painful conditions.” The US NPS cluster “fractures, contusions, sprains and strains” was retained as a diagnostic cluster separate from the clusters commonly associated with chronic pain. The US NPS cluster “limb and extremity pain, arthritic disorders, pain in joint” had included a broad range of conditions and aggregated pain conditions that the authors determined would be valuable to differentiate. Specifically, within the “limb and extremity pain” cluster, there was a subcategory that combined “Pain in joint, osteoarthritis, and limb/extremity pain,” however we created three separate subcategories for these diagnoses. In addition, the US NPS framework had a subcategory within limb and extremity pain, “Other arthritic disorders, including infective arthritic diseases (excluding osteoarthritis, joint and limb pain),” which included bone infections and infectious arthritic diseases. We identified these as separate subcategories and moved these to the “other painful conditions” cluster in the Pain Condition Crosswalk.

Lastly, the US NPS cluster “other painful conditions,” which had been specified to include sickle cell disease, Complex Regional Pain Syndrome, systemic lupus erythematosus, acquired deformities (excluding spinal disorders), spinal cord injury, Lyme Disease, and neuropathic pain was reorganized. In our Pain Condition Crosswalk, “neuropathy” is designated as its own diagnostic cluster as well as “systemic diseases or disorders causing pain.” Multiple subcategories were added within the clusters, “systemic diseases or disorders causing pain” and “other painful conditions” to promote identification of the many pain conditions which are included in these relatively broad clusters.

Consistency across the ICD-9 to ICD-10 transition

The estimated prevalence of common pain conditions across the transition to ICD-10-CM were similar, indicating consistency in the performance of the crosswalk over time (Table 2). The percentage of the sample with an encounter typically related to chronic pain (clusters 1–12) was 56.3%, 58.0% and 63.9% during the ICD-9-CM period at KPNW, GHC and VHA respectively; during the ICD-10-CM period percentages were 56.6%, 57.8% and 63.1% respectively. The percentage of the sample with an encounter related to the common acute pain-related conditions, fractures, contusions, sprains or strains, was 7.7%, 13.6% and 7.9% during the ICD-9-CM period at KPNW, GHC and VHA respectively; during the ICD-10-CM period percentages were 10.2%, 14.7% and 5.9% respectively. ICD-10-CM percentages were within 4 percentage points of ICD-9-CM population percentages (absolute difference) for every pain-related diagnostic cluster and subcategory within the KPNW, GHC and VHA health care systems; the greatest absolute difference observed was 3.1, which resulted in a relative difference greater than 20% and is addressed below.

There were some relative differences in the percent of individuals in the sample with a pain-related diagnosis from the ICD-9-CM period to the ICD-10-CM period which exceeded 20% in select clusters with low prevalence overall. Among the KPNW population, the prevalence of the “orofacial, ear, and temporomandibular disorder pain” cluster from the ICD-9-CM period to the ICD-10-CM period decreased from 1.3% (n=4,655) to 0.8% (n=2,987), which is a relative difference of −38.5%. For the VHA population in this cluster there was also a decrease, which exceeded the threshold, at 22.2% and the GHC population had a decrease of

20%. This decrease occurred in the family of diagnoses related to temporomandibular joint disorders, specifically the codes related to “unspecified” disorders and arthralgia of the temporomandibular joint. However, the overall prevalence rates for this cluster are low, ranging from 0.8% to 1.5% across the sites, making any difference from ICD-9-CM to ICD-10-CM result in large relative differences. Similarly, among the VHA population another large relative difference in a low prevalence cluster, “systemic disorders or diseases causing pain,” was observed with the percent who received a diagnosis in this cluster decreasing from 0.9% (n=4,372) to 0.6% (n=3,628) between the two periods – a 33.3% change.

Another relative difference greater than 20% was observed at two of the sites in the cluster “fractures, contusions, sprains and strains,” which had a relative increase of 32.5% in prevalence overall from 7.7% (n=27,199) to 10.2% (n=37,738) at KPNW and a relative decrease of 25.3% among the VHA population from 7.9% (n=40,951) to 5.9% (n=33,019). At KPNW, this was due to the increase those who received a diagnosis in the subcategory of “general injury” and was driven by the ICD-10-CM codes in the family “injury of unspecified body region.” At VHA, the decrease in the acute cluster was driven by changes in the “joint injury” diagnoses from ICD-9-CM to 10. Within the GHC cohort, the only discrepancy observed was in the “other painful conditions” cluster, which had a relative increase from ICD-9-CM to ICD-10-CM of 34.1% and was driven by the “general pain” subcategory which includes codes related to unspecified pain.

The proportion of the in-person outpatient or inpatient encounters with a pain-related diagnostic code was also consistent across the two time periods (Table 3). Overall, 28.9%, 32.3% and 13.8% of encounters involved any generally chronic pain-related code (clusters 1–12) during the ICD-9-CM period at KPNW, GHC and VHA respectively; during the ICD-10-CM period 28.8%, 31.1% and 13.6% of encounters were related to chronic pain. Encounters related to the common acute pain-related conditions, fractures, contusions, sprains or strains, during the ICD-9-CM period represented 1.7% of encounters at KPNW, 4.3% at GHC and 0.7% at VHA; during ICD-10-CM the percent of encounters were 2.8%, 4.2% and 0.5% respectively. For encounters, ICD-10-CM percentages were within 2 percentage points of ICD-9-CM population percentages for every pain-related diagnostic cluster and subcategory within all three health care systems; relative differences were not assessed.

Proportions of patients who had at least one pain-related in-person encounter in both time periods by age, sex, race and ethnicity were also comparable between the two time periods for each cluster (Tables 4 and 5). Because this analysis included only individuals who had at least one in-person encounter during both time periods, we expected that the crosswalk should identify similar people by cluster for the two periods. Any variation would be due to individuals receiving care in both periods but not for the same pain-related condition. As expected, no relative differences that reached 20% were observed in any of the three health systems and the vast majority were less than 5%. In KPNW the mean age of the sample with an encounter generally related to chronic pain (clusters 1–12) was 53.4 years in the ICD-9-CM and 49.0 in the ICD-10-CM period, an appropriate increase due to the amount of time between the two periods, and 56% were female in each period. Similarly, the mean age of

those with an encounter commonly associated with chronic pain at GHC was 48.8 years and 54.6 years during each period and 59.6% and 59.4% of the sample were female in each period. The VHA population with an encounter in both time periods and a commonly chronic pain-related encounter were younger than KPNW and GHC and had more men, as would be expected, with a mean age of 38.7 years and 40.1 years in each period and 13.9% and 14.1% female. During ICD-9-CM and ICD-10-CM periods at KPNW, the race and ethnicity of the sample with an encounter related to common chronic pain conditions was 84.1% and 83.9% White respectively, 3.5% and 3.6% Black or African American, and 12.4% and 12.5% described their race as other in each period; 6.5% were Hispanic across the periods. At GHC the race and ethnicity of the sample during the two periods was 78.5% White, 5.0% and 4.9% Black or African American, and 16.5% and 16.6% some other race; 4.9% were Hispanic in each period. Among the VHA sample of patients who had an encounter commonly associated with chronic pain, 60.9% were White during ICD-9-CM and 60.5% during ICD-10-CM, 17.1% and 17.4% were Black or African American, and 22.0% were described as other; the proportion of individuals who were Hispanic was 11.8% for both periods.

Discussion.

We developed and assessed a new tool to assess chronic pain prevalence across the ICD-9-CM to ICD-10-CM transition: The Pain Condition Crosswalk. This required identifying and mapping ICD-9-CM and ICD-10-CM diagnosis codes for common pain conditions in order to obtain prevalence rates, encounter rates and socio-demographic correlates that were comparable both before and after the ICD-10-CM transition within three different health care settings. The crosswalk includes a broad spectrum of common pain conditions, both chronic and acute causes of pain, to enable assessment of multiple and chronic overlapping pain conditions. The fact that we found similar prevalence rates, encounter rates, and socio-demographic features before and after the ICD-10 CM transition is reassuring that we have identified nearly equivalent sets of diagnostic codes under the two coding systems.

The crosswalk showed consistent prevalence patterns before and after the ICD-10 transition for nearly all conditions and limited differences were observed. Only one difference was observed across all three sites within the “orofacial, ear, and temporomandibular disorder pain” cluster. However, this cluster overall has low prevalence, making small differences between the two periods result in large relative differences. We identified the family of codes which drove the discrepancy, but it is not clear why their use changed between the two periods at all sites. We observed another difference in a cluster with low prevalence overall at VHA only, “systemic disorders and diseases causing pain.” Another difference was observed for the “other painful conditions” cluster at GHC, which was driven by the non-specific “general pain” subcategory. Yet no difference was observed in this cluster at the other sites, suggesting it might be due to an occurrence or coding practice specific to the site. Lastly, KPNW and VHA exhibited changes in the “fractures, contusions, sprains and strains” cluster but in different directions and due to different subcategories of codes, suggesting it is not related to coding but perhaps the one-time acute nature of these conditions and their fluctuation over time.

There were some limitations to our analyses. First, our assessment of the crosswalk's consistency assumed that pain prevalence rates would be similar during two distinct year-long time periods within three different integrated health care systems. These pain conditions span a range of medical specialties, and we did not assess whether changes occurred within the health care systems that might affect the accessibility of services for these conditions, thereby impacting treatment rates. Nor did we assess whether there were major changes in the populations that these systems served, perhaps due to expansion of service regions or loss of health plan members. There were slight differences among the sites in the proportion who had encounters in both periods, 60% at KPNW, 58.6% at GHC and 67% at VHA. Although we assessed the consistency of the Pain Condition ICD-9-CM to ICD-10-CM Crosswalk in detecting rates of pain conditions across the transition to ICD-10-CM, we did not assess the accuracy of the crosswalk at identifying patients with each pain condition. A validation study could be done to determine the Crosswalk's accuracy by conducting follow-up chart reviews on a subset of patients.

Although our tool relies on a single data element from the EHR – diagnostic visit codes – and is thus dependent on the quality and completeness of the data recorded in this field, because ICD diagnostic codes are widely utilized and available for health care encounters, the crosswalk is an accessible and feasible method to assess prevalence across many settings. In addition, it is the only tool providing a crosswalk from ICD-9-CM to ICD-10-CM for the broad range of common pain conditions as well as a framework for the conditions in ICD-10-CM, satisfying a US NPS population research objective to refine the initially proposed diagnostic clusters and adapt the diagnostic clusters to ICD-10 nomenclature. Including other EHR data elements such as pain scores and medications could improve the tool's ability to robustly identify all individuals with chronic pain conditions and these additional data sources have been combined to create an algorithm to identify individuals with select chronic pain conditions using ICD-9-CM codes by Tian and colleagues,[18] however, a tool such as this is still needed for ICD-10-CM.

With increasingly sophisticated methods available for analyzing large datasets and growing recognition of need to close the gap between clinical care and research, EHR data are becoming pivotal for identifying target patient populations and for describing clinical profiles in a manner consistent with everyday clinical work flow. Our systematic diagnostic framework performs consistently across three distinct health systems and comprehensively covers the broadest range of pain-related conditions, allowing it to serve a critical role in moving this research forward. It also enables researchers to select clusters or subcategories of conditions to assess independently or simultaneously to better understand the prevalence of coexisting pain conditions and their treatment within the US health care system. This framework can be used for a variety of research endeavors, including: health services research that better captures the co-occurrence of various pain conditions; research on the pathways of care associated with complex clinical presentations; identification and characterization of a generalizable population of patients with persistent pain conditions; and, in combination with survey data, research to capture important parameters of clinical care outcomes that are not routinely captured in the EHR (e.g., patient reported outcomes). Thus, the Pain Condition ICD-9-CM to ICD-10-CM Crosswalk and comprehensive

classification of pain-related conditions can serve as critical research infrastructure and advance the field of chronic pain management and treatment.

Acknowledgements.

The authors gratefully acknowledge Matthew Slaughter at the Kaiser Permanente Center for Health Research, Malia Oliver at the Kaiser Permanente Washington Health Research Institute, and Melissa Skanderson at the VA Connecticut Healthcare System for their work on the data extraction and analyses related to this manuscript. In addition, the authors thank Neon Brooks at the Kaiser Permanente Center for Health Research for her work in editing the manuscript.

The study is supported by the National Institutes of Health (NIH) Common Fund, through a cooperative agreement (UH2AT007788, UH3NS088731) from the Office of Strategic Coordination within the Office of the NIH Director. The views presented here are solely the responsibility of the authors and do not necessarily represent the official views of the National Institutes of Health.

References

1. Cherkin DC, Deyo RA, Volinn E, Loeser JD. Use of the International Classification of Diseases (ICD-9-CM) to identify hospitalizations for mechanical low back problems in administrative databases. Spine (Phila Pa 1976.) 17:817–825, 1992 [PubMed: 1386943]
2. Chronic Pain Research Alliance: Impact of Chronic Overlapping Pain Conditions on Public Health and the Urgent Need for Safe and Effective Treatment, Chronic Pain Research Alliance, 2015.
3. Dahlhamer J, Lucas J, Zelaya C, Nahin R, Mackey S, DeBar L, Kerns R, Von Korff M, Porter L, Helmick C. Prevalence of Chronic Pain and High-Impact Chronic Pain Among Adults - United States, 2016. MMWR. Morbidity and mortality weekly report 67:1001–1006, 2018 [PubMed: 30212442]
4. DeBar L, Benes L, Bonifay A, Deyo RA, Elder CR, Keefe FJ, Leo MC, McMullen C, Mayhew M, Owen-Smith A, Smith DH, Trinacty CM, Vollmer WM. Interdisciplinary team-based care for patients with chronic pain on long-term opioid treatment in primary care (PPACT) - Protocol for a pragmatic cluster randomized trial. Contemp Clin Trials 67:91–99, 2018 [PubMed: 29522897]
5. Fillingim RB, Bruehl S, Dworkin RH, Dworkin SF, Loeser JD, Turk DC, Widerstrom-Noga E, Arnold L, Bennett R, Edwards RR, Freeman R, Gewandter J, Hertz S, Hochberg M, Krane E, Mantyh PW, Markman J, Neogi T, Ohrbach R, Paice JA, Porreca F, Rappaport BA, Smith SM, Smith TJ, Sullivan MD, Verne GN, Wasan AD, Wesselmann U. The ACTTION-American Pain Society Pain Taxonomy (AAPT): an evidence-based and multidimensional approach to classifying chronic pain conditions. J Pain 15:241–249, 2014 [PubMed: 24581634]
6. Fung KW, Richesson R, Smerek M, Pereira KC, Green BB, Patkar A, Clowse M, Bauck A, Bodenreider O. Preparing for the ICD-10-CM Transition: Automated Methods for Translating ICD Codes in Clinical Phenotype Definitions. EGEMS (Washington, DC) 4:1211, 2016
7. Goulet JL, Kerns RD, Bair M, Becker WC, Brennan P, Burgess DJ, Carroll CM, Dobscha S, Driscoll MA, Fenton BT, Fraenkel L, Haskell SG, Heapy AA, Higgins DM, Hoff RA, Hwang U, Justice AC, Piette JD, Sinnott P, Wandner L, Womack JA, Brandt CA. The musculoskeletal diagnosis cohort: examining pain and pain care among veterans. Pain 157:1696–1703, 2016 [PubMed: 27023420]
8. Haskell SG, Brandt CA, Krebs EE, Skanderson M, Kerns RD, Goulet JL. Pain among Veterans of Operations Enduring Freedom and Iraqi Freedom: do women and men differ? Pain Med 10:1167–1173, 2009 [PubMed: 19818028]
9. Higgins DM, Kerns RD, Brandt CA, Haskell SG, Bathulapalli H, Gilliam W, Goulet JL. Persistent pain and comorbidity among Operation Enduring Freedom/Operation Iraqi Freedom/operation New Dawn veterans. Pain Med 15:782–790, 2014 [PubMed: 24548466]
10. Institute of Medicine: Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education and Research, Washington DC, 2011.
11. Interagency Pain Research Coordinating Committee: National Pain Strategy: A Comprehensive Population Health-Level Strategy by Pain, 2015.

12. Maixner W, Fillingim RB, Williams DA, Smith SB, Slade GD. Overlapping Chronic Pain Conditions: Implications for Diagnosis and Classification. J Pain 17:T93–t107, 2016 [PubMed: 27586833]
13. Pitcher MH, Von Korff M, Bushnell MC, Porter L. Prevalence and Profile of High-Impact Chronic Pain in the United States. J Pain 2018
14. Centers for Disease Control and Prevention: International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) 2017 Available at: https://www.cdc.gov/nchs/icd/icd10cm.htm Accessed 02/03/2017.
15. Centers for Disease Control and Prevention: International Classification of Diseases, (ICD-10-CM/PCS) Transition - Background 2018 Available at: https://www.cdc.gov/nchs/icd/icd10cm_pcs_background.htm Accessed August 10, 2018.
16. Raebel MA, Newcomer SR, Reifler LM, Boudreau D, Elliott TE, Debar L, Ahmed A, Pawloski PA, Fisher D, Donahoo WT, Bayliss EA. Chronic Use of Opioid Medications Before and After Bariatric Surgery. JAMA 310:1369–1376, 2013 [PubMed: 24084922]
17. Starfield B, Kinder K. Multimorbidity and its measurement. Health Policy 103:3–8, 2011 [PubMed: 21963153]
18. Tian TY, Zlateva I, Anderson DR. Using electronic health records data to identify patients with chronic pain in a primary care setting. Journal of the American Medical Informatics Association : JAMIA 20:e275–280, 2013 [PubMed: 23904323]
19. Treede RD, Rief W, Barke A, Aziz Q, Bennett MI, Benoliel R, Cohen M, Evers S, Finnerup NB, First MB, Giamberardino MA, Kaasa S, Kosek E, Lavand'homme P, Nicholas M, Perrot S, Scholz J, Schug S, Smith BH, Svensson P, Vlaeyen JW, Wang SJ. A classification of chronic pain for ICD-11. Pain 156:1003–1007, 2015 [PubMed: 25844555]
20. Von Korff M, Scher AI, Helmick C, Carter-Pokras O, Dodick DW, Goulet J, Hamill-Ruth R, LeResche L, Porter L, Tait R, Terman G, Veasley C, Mackey S. United States National Pain Strategy for Population Research: Concepts, Definitions, and Pilot Data. J Pain 17:1068–1080, 2016 [PubMed: 27377620]
21. Weiner JP, Dobson A, Maxwell SL, Coleman K, Starfield B, Anderson GF. Risk-adjusted Medicare capitation rates using ambulatory and inpatient diagnoses. Health care financing review 17:77–99, 1996
22. Yoon J, Chow A. Comparing chronic condition rates using ICD-9 and ICD-10 in VA patients FY2014–2016. BMC Health Serv Res 17:572, 2017 [PubMed: 28818082]

Highlights

- Research on the prevalence and co-occurrence of common pain conditions is needed
- ICD-10-CM introduced challenges to assessing pain condition prevalence over time
- We developed an ICD-9-CM and ICD-10-CM crosswalk for common pain conditions
- It was assessed based on stability of prevalence estimates and patient demographics
- Offers a standard tool for health services and epidemiologic research on pain

Perspective.

This article details the development and assessment of the Pain Condition ICD-9-CM to ICD-10-CM Crosswalk, a diagnostic framework for assessing pain condition prevalence across the ICD-9-CM to ICD-10-CM transition. This framework can serve as a standardized tool for research on pain conditions, including health services and epidemiologic research.

Table 1.

Pain Condition ICD-9-CM to ICD-10-CM Crosswalk Diagnostic Clusters

Conditions commonly associated with chronic pain	**1. Back pain**
	2. Neck pain
	3. Limb/extremity pain, joint pain and non-systemic, non-inflammatory arthritic disorders
	Carpal tunnel
	Gout and other crystal arthropathies
	Joint pain
	Limb/extremity pain
	Neuropathic arthropathy
	Osteoarthritis
	Other non-systemic, non-inflammatory arthritic disorders
	4. Fibromyalgia
	5. Headache
	6. Orofacial, ear, and temporomandibular disorder pain
	7. Abdominal and bowel pain
	General abdominal pain
	Hernia
	Irritable Bowel Syndrome
	Kidney/gall stones
	8. Urogenital, pelvic and menstrual pain
	Cystitis and bladder disorders
	Endometriosis
	Menstrual pain
	Other disorders of female reproductive system
	Other disorders of male reproductive system
	Prostatitis
	Urinary calculus
	Vulvodynia
	9. Musculoskeletal chest pain
	10. Neuropathy
	Diabetic neuropathy
	Neuropathy without mention of diabetes
	Optic neuropathy
	11. Systemic disorders or diseases causing pain
	Complex Regional Pain Syndrome
	Lyme disease
	Other inflammatory arthropathies
	Other systemic disorders

	Rheumatoid Arthritis
	Sickle Cell Disease
	Systemic lupus erythematosus
	12. Other painful conditions
	Acquired deformities (excluding back conditions)
	Cancer-related pain
	General pain
	Post-operative pain
	Post-trauma pain
	Restless legs syndrome (RLS)
	Spinal cord injury
	Bone infections
	Infectious arthritic diseases
Conditions commonly associated with acute pain	**13. Fractures, contusions, sprains and strains**
	Contusions
	Fractures
	General injury
	Joint injury
	Sprains and strains

Table 2.

Adult Populations with Encounter (Outpatient or Inpatient) During ICD-9-CM Period (10/14–09/15) Compared to ICD-10-CM Period (1/16–12/16) by Pain Condition Diagnostic Cluster

	KPNW Population						Group Health Population						VHA Population					
	ICD-9-CM Total N=351,778		ICD-10-CM Total N=368,947		Absolute Difference	% Change	ICD-9-CM Total N=286,861		ICD-10-CM Total N=261,972		Absolute Difference	% Change	ICD-9-CM Total N=515,541		ICD-10-CM Total N=563,426		Absolute Difference	% Change
	N	%	N	%			N	%	N	%			N	%	N	%		
1. Back pain	57,446	16.3	62,367	16.9	0.6	3.7%	60,930	21.2	53,315	20.4	−0.8	−3.8%	169,908	33.0	178,310	31.7	1.3	−3.9%
2. Neck pain	22,254	6.3	24,670	6.7	0.4	6.3%	32,697	11.4	28,388	10.8	−0.6	−5.3%	47,157	9.2	47,116	8.4	0.8	−8.7%
3. Limb/extremity pain, joint pain and non-systemic, non-inflammatory arthritic disorders	114,304	32.5	119,399	32.4	−0.1	−0.3%	97,553	34	88,776	33.9	−0.1	−0.3%	201,381	39.1	209,259	37.1	2.0	−5.1%
Carpal tunnel	4,905	1.4	4,849	1.3	−0.1		3,605	1.3	3,134	1.2	−0.1		10,941	2.1	10,925	1.9	0.2	
Gout and other crystal arthropathies	5,148	1.5	6,381	1.7	0.2		6,545	2.3	5,825	2.2	−0.1		11,653	2.3	12,846	2.3	0.0	
Joint pain	80,326	22.8	75,549	20.5	−2.3		67,056	23. 4	57,854	22.1	−1.3		156,840	30.4	154,097	27.4	3.0	
Limb/extremity pain	47,704	13.6	52,827	14.3	0.7		45,186	15.8	41,601	15.9	0.1		53,844	10.4	66,894	11.9	−1.5	
Neuropathic arthropathy	169	0.1	126	0.0	−0.02		182	0.06	125	0.05	−0.01		38	0.01	41	0.01	0.0	
Osteoarthritis	19,923	5.7	28,898	7.8	2.1		31,085	10.8	30,924	11.8	1		39,801	7.7	35,720	6.3	1.4	
Other non-systemic, non-inflammatory arthritic disorders	17	0.00	251	0.1	0.1		51	0.02	293	0.1	0.08		147	0.03	4,436	0.8	−0.8	
4. Fibromyalgia	10,574	3.0	11,474	3.1	0.1	3.3%	8,918	3.1	8,444	3.2	0.1	3.2%	8,982	1.7	10,246	1.8	−0.1	5.9%
5. Headache	24,074	6.8	26,900	7.3	0.5	7.4%	22,419	7.8	19,277	7.4	−0.4	−5.1%	70,695	13.7	71,426	12.7	1.0	−7.3%
6. Orofacial, ear, and temporomandibular disorder pain	4,655	1.3	2,987	0.8	−0.5	−38.5%	4,363	1.5	3,135	1.2	−0.3	−20.0%	4,766	0.9	3,828	0.7	0.2	−22.2%
7. Abdominal and bowel pain	36,421	10.4	45,059	12. 2	1.8	17.3%	37,339	13	34,100	13	0	0.0%	41,243	8.0	42,806	7.6	0.4	−5.0%
General abdominal pain	27,886	7.9	34,540	9.4	1.5		30,099	10.5	27,361	10.4	−0.1		22,104	4.3	22,821	4.1	0.2	
Hernia	4,929	1.4	6,761	1.8	0.4		5,876	2.1	5,441	2.1	0		9,317	1.8	8,179	1.5	0.3	
Irritable Bowel Syndrome	3,927	1.1	4,744	1.3	0.2		3,086	1.1	2,807	1.1	0		8,275	1.6	10,207	1.8	−0.2	
Kidney/gallstones	3,964	1.1	5,259	1.4	0.3		5,667	2.0	5,101	2.0	0		7,215	1.4	7,402	1.3	0.1	
8. Urogenital, pelvic and menstrual pain	14,345	4.1	14,048	3.8	−0.3	−7.3%	11,397	4.0	8,259	3.2	−0.8	−20.0%	10,591	2.1	9,806	1.7	0.4	−19.0%
Cystitis and bladder disorders	266	0.1	292	0.1	0.0		170	0.06	137	0.05	−0.01		196	0.04	224	0.04	0.0	
Endometriosis	618	0.2	852	0.2	0.0		746	0.3	654	0.3	0		828	0.2	857	0.2	0.0	
Menstrual pain	3,008	0.9	3,044	0.8	−0.1		2,372	0.8	1,881	0.7	−0.1		1,910	0.4	1,824	0.3	0.1	
Other disorders of female reproductive system	7,913	2.3	7,644	2.1	−0.2		6,481	2.3	4,506	1.7	−0.6		2,319	0.5	3,445	0.6	−0.1	
Other disorders of male reproductive system	1,890	0.5	1,401	0.4	−0.1		1,461	0.5	891	0.3	−0.2		4,517	0.9	2,803	0.5	0.4	
Prostatitis	1,057	0.3	1,160	0.3	0.0		782	0.3	647	0.3	0		1,242	0.2	1,233	0.2	0.0	

J Pain. Author manuscript; available in PMC 2020 December 01.

	KPNW Population						Group Health Population						VHA Population					
	ICD-9-CM Total N=351,778		ICD-10-CM Total N=368,947		Absolute Difference	% Change	ICD-9-CM Total N=286,861		ICD-10-CM Total N=261,972		Absolute Difference	% Change	ICD-9-CM Total N=515,541		ICD-10-CM Total N=563,426		Absolute Difference	% Change
	N	%	N	%			N	%	N	%			N	%	N	%		
Urinary calculus	494	0.1	610	0.2	0.1		347	0.1	302	0.1	0		403	0.1	327	0.06	0.0	
Vulvodynia	307	0.1	332	0.1	0.0		91	0.03	88	0.03	0		28	0.01	55	0.01	0.0	
9. Musculoskeletal chest pain	21,861	6.2	26,125	7.1	0.9	14.5%	25,536	8.9	23,380	8.9	0	0.0%	20,298	3.9	22,613	4.0	−0.1	2.6%
10. Neuropathy	19,807	5.6	19,342	5.2	−0.4	−7.1%	17,977	6.3	17,203	6.6	0.3	4.8%	11,527	2.2	11,226	2.0	0.2	−9.1%
Diabetic neuropathy	10,737	3.1	9,567	2.6	−0.5		9,863	3.4	9,115	3.5	0.1		1,932	0.4	3,559	0.6	−0.2	
Neuropathy without mention of diabetes	10,450	3.0	10,744	2.9	−0.1		9,610	3.4	9,195	3.5	0.1		10,127	2.0	7,822	1.4	0.6	
Optic neuropathy	279	0.1	324	0.1	0.0		197	0.07	213	0.08	0.01		135	0.03	349	0.06	0.0	
11. Systemic disorders or diseases causing pain	5,278	1.5	5,833	1.6	0.1	6.7%	5,168	1.8	4,356	1.7	−0.1	−5.6%	4,372	0.9	3,628	0.6	0.3	−33.3%
Complex Regional Pain Syndrome	133	0.04	221	0.1	0.02		92	0.03	167	0.06	0.03		183	0.04	495	0.09	−0.1	
Lyme disease	19	0.01	19	0.0	0.00		37	0.01	25	0.01	0		254	0.05	252	0.04	0.0	
Other inflammatory arthropathies	1,407	0.4	1,597	0.4	0.0		1,289	0.5	1,276	0.5	0		333	0.06	392	0.07	0.0	
Other systemic disorders	1	0.0	5	0.0	0.0		461	0.2	73	0.03	−0.2		1,526	0.3	57	0.01	0.3	
Rheumatoid Arthritis	3,395	1.0	3,608	1.0	0.0		2,917	1.0	2,460	0.9	−0.1		1,432	0.3	1,670	0.3	0.0	
Sickle Cell Disease	99	0.03	162	0.0	0.01		145	0.05	127	0.05	0		376	0.07	335	0.06	0.0	
Systemic lupus erythematosus	366	0.1	423	0.1	0.0		475	0.2	407	0.2	0		383	0.07	552	0.1	0.0	
12. Other painful conditions	25,308	7.2	30,277	8.2	1.0	13.9%	25,491	8.9	31,337	12	3.1	34.8%	41,546	8.1	54,615	9.7	−1.6	19.8%
Acquired deformities (excluding back conditions)	5,124	1.5	6,445	1.8	0.3		7,170	2.5	6,981	2.7	0.2		16,804	3.3	13,382	2.4	0.9	
Cancer-related pain	501	0.1	599	0.2	0.1		464	0.2	460	0.2	0		78	0.02	103	0.02	0.0	
General pain	17,055	4.9	20,295	5.5	0.6		14,203	5.0	21,141	8.1	3.1		23,337	4.5	37,580	6.7	−2.2	
Post-operative pain	791	0.2	1,478	0.4	0.2		3,522	1.2	3,383	1.3	0.1		704	0.1	1,355	0.2	−0.1	
Post-trauma pain	10	0.0	35	0.0	0.0		242	0.08	243	0.09	0.01		512	0.1	1,711	0.3	−0.2	
Restless legs syndrome (RLS)	3,235	0.9	3,576	1.0	0.1		2,328	0.8	2,316	0.9	0.1		1,753	0.3	3,503	0.6	−0.3	
Spinal cord injury	18	0.01	39	0.0	0.0		66	0.02	73	0.03	0.01		236	0.05	197	0.03	0.0	
Bone infections	335	0.1	485	0.1	0.0		556	0.2	601	0.2	0		384	0.07	428	0.08	0.0	
Infectious arthritic diseases	83	0.02	113	0.0	0.01		144	0.05	141	0.05	0		160	0.03	305	0.05	0.0	
All people with encounters with pain diagnosis in clusters 1–12	197,909	56.3	208,750	56.6	0.3	0.5%	166,263	58.0	151,505	57.8	−0.2	−0.3%	329,558	63.9	355,797	63.1	0.8	−1.3%
13. Fractures, contusions, sprains and strains	27,199	7.7	37,738	10.2	2.5	32.5%	38,929	13.6	38,445	14.7	1.1	8.1%	40,951	7.9	33,019	5.9	2.0	−25.3%
Contusions	7,464	2.1	9,669	2.6	0.5		11,677	4.1	10,813	4.1	0		5,280	1.0	5,337	1.0	0.0	
Fractures	6,168	1.8	8,948	2.4	0.6		9,933	3.5	8,790	3.4	−0.1		9,490	1.8	7,376	1.3	0.5	
General injury	1,088	0.3	5,588	1.5	1.2		3,892	1.4	6,961	2.7	1.3		2,811	0.6	1,715	0.3	0.3	

	KPNW Population						Group Health Population						VHA Population					
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	N	%	N	%			N	%	N	%			N	%	N	%		
Joint injury	3,329	1.0	3,947	1.1	0.1		8,068	2.8	7,617	2.9	0.1		14,385	2.8	9,754	1.7	1.1	
Sprains and strains	12,200	3.5	16,161	4.4	0.9		16,125	5.6	15,287	5.8	0.2		14,424	2.8	12,435	2.2	0.6	
All people with health care encounters with any pain condition diagnosis	203,077	57.7	215,857	58.5	0.8	1.3%	171,039	59.6	157,055	60.0	0.3	0.5%	335,388	0.7	360,335	0.6	0.01	−1.7%

Table 3.

Encounters (Outpatient or Inpatient) with Pain Condition Diagnosis by Cluster During ICD-9-CM Period (10/14–09/15) Compared to ICD-10-CM Period (1/16–12/16)

	KPNW Health Care Encounters N (%)		GHC Health Care Encounters N (%)		VHA Health Care Encounters N (%)	
	ICD-9-CM Total Encounters = 2,131,154	**ICD-10-CM Total Encounters = 2,405,311**	**ICD-9-CM Total Encounters = 2,772,109**	**ICD-10-CM Total Encounters = 2,652,914**	**ICD-9-CM Total Encounters = 13,992,691**	**ICD-10-CM Total Encounters = 15,312,267**
1. Back pain	123,448 (5.8)	141,206 (5.9)	275,613 (9.9)	240,595 (9.1)	590,709 (4.2)	614,298 (4.0)
2. Neck pain	44,236 (2.1)	51,662 (2.2)	151,034 (5.5)	130,784 (4.9)	139,050 (1.0)	140,902 (0.9)
3. Limb/extremity pain, joint pain and non-systemic, non-inflammatory arthritic disorders	284,111 (13.3)	310,464 (12.9)	380,749 (13.7)	344,323 (13.0)	702,408 (5.0)	775,716 (5.1)
Carpal tunnel Gout and other crystal arthropathies Joint pain Limb/extremity pain Neuropathic arthropathy Osteoarthritis Other non-systemic, non-inflammatory arthritic disorders	8,700 (0.4) 8,165 (0.4) 176,556 (8.3) 80,621 (3.8) 660 (0.03) 35,674 (1.7) 21 (0.0)	9,057 (0.4) 10,917 (0.5) 167,010 (6.9) 95,138 (4.0) 395 (0.02) 58,126 (2.4) 286 (0.01)	9,943 (0.4) 12,240 (0.4) 229,756 (8.3) 113,554 (4.1) 582 (0.02) 70,820 (2.6) 164 (0.01)	8,339 (0.3) 10,970 (0.4) 197,976 (7.5) 103,957 (3.9) 370 (0.01) 73,918 (2.8) 592 (0.02)	25,419 (0.2) 21,784 (0.2) 463,249 (3.3) 110,764 (0.8) 112 (0.0) 80,837 (0.6) 243 (0.0)	27,850 (0.2) 25,686 (0.2) 486,008 (3.2) 154,766 (1.0) 100 (0.0) 74,102 (0.5) 7,204 (0.05)
4. Fibromyalgia	18,693 (0.9)	21,081 (0.9)	23,367 (0.8)	24,138 (0.9)	22,022 (0.2)	25,340 (0.2)
5. Headache	40,481 (1.9)	47,723 (2.0)	53,202 (1.9)	47,268 (1.8)	165,775 (1.2)	170,178 (1.1)
6. Orofacial, ear, and temporomandibular disorder pain	6,651 (0.3)	4,387 (0.2)	10,418 (0.4)	7,082 (0.3)	6,823 (0.05)	5,164 (0.03)
7. Abdominal and bowel pain	58,094 (2.7)	83,467 (3.5)	90,759 (3.3)	87,614 (3.3)	100,203 (0.7)	106,142 (0.7)
General abdominal pain Hernia Irritable Bowel Syndrome Kidney/gall stones	40,282 (1.9) 8,035 (0.4) 5,251 (0.3) 6,498 (0.3)	57,783 (2.4) 11,998 (0.5) 6,599 (0.3) 10,158 (0.4)	62,688 (2.3) 13,961 (0.5) 4,954 (0.2) 16,035 (0.6)	60,433 (2.3) 13,202 (0.5) 4,684 (0.2) 15,098 (0.6)	44,588 (0.3) 21,711 (0.2) 13,937 (0.1) 19,967 (0.1)	45,808 (0.3) 22,038 (0.1) 17,521 (0.1) 20,775 (0.1)
8. Urogenital, pelvic and menstrual pain	21,369 (1.0)	22,539 (0.9)	19,743 (0.7)	15,453 (0.6)	20,539 (0.2)	18,874 (0.1)
Cystitis and bladder disorders Endometriosis Menstrual pain Other disorders of female reproductive system Other disorders of male reproductive system Prostatitis Urinary calculus Vulvodynia	592 (0.03) 1,180 (0.06) 3,834 (0.2) 11,745 (0.6) 2,426 (0.1) 1,432 (0.1) 689 (0.03) 438 (0.02)	648 (0.03) 1,488 (0.06) 3,930 (0.2) 12,510 (0.5) 1,849 (0.08) 1,645 (0.07) 934 (0.04) 466 (0.02)	540 (0.02) 1,631 (0.06) 4,030 (0.2) 10,309 (0.4) 2,143 (0.08) 1,226 (0.04) 718 (0.03) 161 (0.01)	482 (0.02) 1,575 (0.06) 3,325 (0.1) 7,731 (0.3) 1,352 (0.05) 975 (0.04) 705 (0.03) 180 (0.01)	617 (0.0) 1,782 (0.01 3,260 (0.02) 4,072 (0.03) 8,095 (0.06) 1,919 (0.01) 741 (0.01) 53 (0.0)	711 (0.00) 1,951 (0.01) 3,047 (0.02) 6,102 (0.04) 4,402 (0.03) 2,011 (0.01) 573 (0.00) 77 (0.00)
9. Musculoskeletal chest pain	31,338 (1.5)	41,634 (1.7)	62,826 (2.3)	59,954 (2.3)	41,461 (0.3)	48,041 (0.3)
10. Neuropathy	63,564 (3.0)	56,113 (2.3)	56,997 (2.1)	51,878 (2.0)	24,366 (0.2)	24,656 (0.2)
Diabetic neuropathy Neuropathy without mention of diabetes Optic neuropathy	44,347 (2.1) 21,245 (1.0) 542 (0.03)	34,479 (1.4) 21,987 (0.9) 715 (0.03)	37,292 (1.4) 21,010 (0.8) 462 (0.02)	31,855 (1.2) 20,397 (0.8) 517 (0.02)	6,025 (0.04) 18,118 (0.1) 223 (0.0)	9,694 (0.06) 14,206 (0.09) 756 (0.0)
11. Systemic disorders or diseases causing pain	16,150 (0.8)	18,069 (0.8)	20,708 (0.8)	16,828 (0.6)	11,649 (0.08)	12,594 (0.08)
Complex Regional Pain Syndrome Lyme disease	274 (0.01) 25 (0.00)	601 (0.02) 30 (0.00)	163 (0.01) 59 (0.00)	432 (0.02) 87 (0.00)	426 (0.00) 408 (0.00)	1,680 (0.01) 398 (0.00)

	KPNW Health Care Encounters N (%)		GHC Health Care Encounters N (%)		VHA Health Care Encounters N (%)	
	ICD-9-CM Total Encounters = 2,131,154	**ICD-10-CM Total Encounters = 2,405,311**	**ICD-9-CM Total Encounters = 2,772,109**	**ICD-10-CM Total Encounters = 2,652,914**	**ICD-9-CM Total Encounters = 13,992,691**	**ICD-10-CM Total Encounters = 15,312,267**
Other inflammatory arthropathies Other systemic disorders Rheumatoid Arthritis Sickle Cell Disease Systemic lupus erythematosus	3,668 (0.2) 1 (0.00) 10,914 (0.5) 255 (0.0) 1,257 (0.06)	4,243 (0.18) 8 (0.00) 11,592 (0.48) 409 (0.02) 1,533 (0.06)	4,050 (0.2) 1,947 (0.07) 12,564 (0.5) 254 (0.01) 1,968 (0.07)	3,980 (0.2) 250 (0.01) 10,417 (0.4) 259 (0.01) 1,590 (0.06)	1,137 (0.01) 2,363 (0.02) 4,976 (0.04) 535 (0.00) 1,865 (0.01)	1,318 (0.01) 72 (0.00) 6,203 (0.04) 552 (0.00) 2,371 (0.02)
12. Other painful conditions	49,163 (2.3)	62,686 (2.6)	55,111 (2.0)	72,200 (2.7)	98,379 (0.7)	139,765 (0.9)
Acquired deformities (excluding back conditions) Cancer-related pain General pain Post-operative pain Post-trauma pain Restless legs syndrome (RLS) Spinal cord injury Bone infections Infectious arthritic diseases	7,585 (0.4) 1,001 (0.05) 34,774 (1.6) 964 (0.05) 12 (0.0) 4,566 (0.2) 24 (0.0) 1,017 (0.05) 214 (0.01)	10,018 (0.4) 1,406 (0.06) 43,838 (1.8) 1,939 (0.08) 41 (0.0) 5,392 (0.2) 60 (0.0) 1,373 (0.06) 245 (0.01)	14,348 (0.5) 1,583 (0.06) 27,876 (1.0) 4,519 (0.2) 401 (0.01) 4,004 (0.1) 154 (0.01) 3,071 (0.1) 525 (0.02)	14,559 (0.6) 1,785 (0.07) 44,069 (1.7) 5,099 (0.2) 427 (0.02) 4,125 (0.2) 120 (0.00) 3,208 (0.1) 421 (0.02)	33,704 (0.2) 252 (0.00) 56,430 (0.4) 1,030 (0.01) 1,139 (0.01) 2,747 (0.02) 943 (0.01) 1,740 (0.01) 394 (0.00)	33,103 (0.2) 423 (0.00) 90,276 (0.6) 2,507 (0.02) 4,008 (0.03) 5,856 (0.04) 762 (0.00) 2,152 (0.01) 678 (0.00)
All encounters with encounters with pain diagnosis in clusters 1–12	616,541 (28.9)	693,407 (28.8)	895,389 (32.3)	825,953 (31.1)	1,923,445 (13.8)	2,081,670 (13.6)
13. Fractures, contusions, sprains and strains	36,092 (1.7)	67,177 (2.8)	120,044 (4.3)	112,259 (4.2)	98,149 (0.7)	70,490 (0.5)
Contusions Fractures General injury Joint injury Sprains and strains	8,438 (0.4) 9,090 (0.4) 1,174 (0.06) 4,364 (0.2) 14,425 (0.7)	13,479 (0.6) 17,534 (0.7) 6,778 (0.3) 6,596 (0.3) 26,995 (1.1)	22,510 (0.8) 34,021 (1.2) 6,222 (0.2) 19,978 (0.7) 49,322 (1.8)	20,115 (0.8) 28,767 (1.1) 10,695 (0.4) 18,210 (0.7) 44,544 (1.7)	6,904 (0.05) 27,638 (0.2) 4,650 (0.03) 32,387 (0.2) 26,570 (0.2)	7,128 (0.05) 19,748 (0.1) 3,086 (0.02) 20,852 (0.1) 19,676 (0.1)
All health care encounters with any pain condition diagnosis	**639,856 (30.0)**	**737,255 (30.7)**	**961,933 (34.7)**	**890,103 (33.6)**	**2,021,594 (14.4)**	**2,152,160 (14.1)**

Table 4.

Age and Gender of Adult Population with Encounters (Outpatient or Inpatient) During Both ICD-9-CM (10/14–09/15) and ICD-10-CM Periods (1/16–12/16) by Pain Condition Diagnostic Cluster

	KPNW Population (N=270,595)					Group Health Population (N=202,777)					VHA Population (N=433,072)				
	Mean Age Y (SD)		Female N (%)			Mean Age Y (SD)		Female N (%)			Mean Age Y (SD)		Female N (%)		
	ICD-9-CM	IC D-10-CM	ICD-9-CM	ICD-10-CM	% Change	ICD-9-CM	IC D-10-CM	ICD-9-CM	ICD-10-CM	%Change	ICD-9-CM	IC D-10-CM	ICD-9-CM	ICD-10-CM	%Change
1. Back pain	53.5 (17.0)	54.6 (17.2)	28,404 (59.5)	29,793 (59.6)	0.2%	56.3 (17.1)	57.3 (17.1)	29,317 (62.3)	28,308 (62.3)	0.0%	38.8 (9.8)	40.0 (9.8)	18,500 (12.0)	18,092 (12.5)	4.0%
2. Neck pain	52.0 (16.0)	52.7 (16.2)	12,224 (65.3)	12981 (65.0)	−0.5%	54.2 (16.4)	55.0 (16.4)	16,510 (65.7)	16,062 (66.1)	0.6%	40.5 (9.8)	41.5 (9.7)	6,819 (15.6)	6,431 (16.5)	5.6%
3. Limb/extremi ty pain, joint pain and non-systemic, non-inflammatory arthritic disorders	55.5 (16.3)	56.9 (16.2)	57,522 (60.0)	57,800 (59.3)	−1.2%	58.7 (16.4)	59.9 (16.3)	47,508 (61.6)	46,855 (61.6)	0.0%	39.8 (10.1)	41.0 (10.1)	23,879 (13.1)	23,157 (13.7)	4.6%
4. Fibromyalgia	54.1 (14.9)	54.9 (15.0)	7,505 (81.6)	8,120 (82.4)	1.0%	56.5 (15.4)	57.2 (15.6)	5,417 (75.8)	5,532 (75.0)	−0.4%	39.9 (9.5)	40.4 (9.4)	2,739 (32.1)	2,901 (32. 7)	2.0%
5. Headache	46.7 (16.4)	48.3 (16.8)	15,212 (76.5)	15,835 (75.3)	−1.6%	51.2 (17.4)	52.6 (17.5)	12,722 (75.5)	11,890 (75.5)	−0.1%	37.2 (8.8)	38.3 (8.7)	13,890 (21.3)	13,193 (22.6)	6.4%
6. Orofacial, ear, and temporomandibular disorder pain	50.1 (17.1)	53.0 (17.2)	2,824 (71.8)	1,722 (69.8)	−2.8%	54.7 (17.6)	56.5 (17.5)	2,390 (70.7)	1,888 (70.0)	−1.0%	37.4 (9.8)	38.6 (9.5)	1,0 08 (23.0)	626 (19.9)	–
7. Abdominal and bowel pain	51.3 (17.6)	52.8 (17.8)	19,170 (63.6)	22,788 (63.5)	−0.2%	55.6 (18.1)	57.1 (18.1)	18,171 (64.0)	17,931 (63.5)	−0.6%	38.6 (9.8)	39.5 (9.6)	7,308 (19.3)	6,641 (18.7)	−3.2%
8. Urogenital, pelvic and menstrual pain	43.1 (16.3)	44.1 (16.7)	9,143 (77.8)	8,089 (77.1)	−0.9%	45.8 (17.5)	47.2 (18.2)	6,421 (77.9)	4,843 (75. 1)	−3.6%	36.9 (9.2)	37.7 (9.0)	4,201 (43.5)	4,021 (49.6)	13.9%
9. Musculoskeletal chest pain	56.8 (17.7)	57.9 (17.5)	10,705 (57.8)	12,394 (57.3)	−0.9%	61.1 (17.2)	62.0 (17.1)	11,649 (57.5)	11,780 (58.1)	1.0%	39.5 (10.1)	40.5 (10.1)	2,583 (13.8)	2,714 (14.4)	4.4%
10. Neuropathy	66.5 (13.2)	67.1 (13.3)	8,833 (50.6)	8,9 65 (50.8)	0.4%	68.4 (13.1)	69.1 (13.0)	7,742 (50.7)	8,217 (51.1)	0.8%	43.4 (10.7)	45.5 (10.7)	1,416 (12.9)	1,293 (13.1)	1.4%
11. Systemic disorders or diseases causing pain	61.2 (15.3)	62.1 (15.5)	3,540 (75.6)	3,875 (74.5)	−1.5%	62.2 (15.7)	63.7 (15.2)	3,194 (74.8)	2,956 (75.0)	0.3%	42.4 (10.0)	42.5 (10.3)	1,160 (28.2)	975 (31.6)	–
12. Other painful conditions	57.8 (15.1)	59.1 (15.3)	13,638 (63.5)	16,334 (62.9)	−0.9%	60.6 (15.8)	61.4 (15.6)	13,143 (64.3)	17,343 (63.6)	−1.1%	39.9 (9.9)	41.2 (9.8)	5,520 (14.4)	6,944 (15.2)	5.9%
All people with encounters with pain diagnosis in clusters 1–12	53.4 (17.2)	54.6 (17.3)	96,605 (59.6)	97,672 (59.4)	−0.3%	56.5 (17.4)	57.7 (17.4)	76,851 (60.9)	76,255 (60.8)	−0.2%	38.7 (10.1)	40.1 (9.9)	40,681 (13.9)	40,302 (14.1)	1.4%
13. Fractures, contusions, sprains and strains	52.5 (17.7)	53.9 (18.2)	12,942 (58.0)	17,511 (58.2)	0.3%	57.9 (18.2)	59.1 (18.2)	18,156 (60.5)	19,620 (60.4)	−0.2%	37.5 (9.7)	38.7 (9.7)	4,349 (11.8)	3,529 (13.2)	11.3%
No pain-related health care encounters	**47.8 (18.1)**	**49.0 (18.0)**	**58,287 (55.6)**	**56,579 (55.8)**	**0.4%**	**50.3 (18.1)**	**51.5 (18.1)**	**41,866 (57.1)**	**41,965 (57.3)**	**0.4%**	**37.3 (10.0)**	**38.7 (10.1)**	**17,369 (12.9)**	**17,847 (12.4)**	**−4.1%**

Table 5.

Race and Ethnicity of Adult Population with Encounters (Outpatient or Inpatient) During Both ICD-9-CM (10/14–09/15) and ICD-10-CM Periods (1/16–12/16) by Pain Condition Diagnostic Cluster

	KPNW Population (N=270,595)											
	Race, N (% of Total Population in Pain Condition Cluster)									Hispanic Ethnicity, N (%of Total Population in Pain Cluster)		
	White			Black or African Amercan			Other					
	ICD-9-C	ICD-10-CM	% Change	ICD-9-CM	IC % D-C1h	% Change	ICD-9-CM	ICD-10-CM	% Change	ICD-9-C	ICD-10-CM	% Change
1. Back pain	40,127 (84.1)	41,929 (83.8)	−0.4%	1,888 (4.0)	2,022 (4.0)	2.0%	5,711 (12.0	6,063 (12.1)	1.3%	3,069 (6.4)	3,353 (6.7)	4.4%
2. Neck pain	15,551 (83.0)	16,298 (81.6)	−1.7%	732 (3.9)	873 (4.4)	−	2449 (.3))	2,797 (14.0)	7.2%	1,266 (6.8)	1,471 (7.4)	9.0%
3. Limb/extremity pain, joint pain and non−systemic, non −inflammatory arthritic disorders	82,086 (85.1	82,920 (85.1)	0.0%	3,415 (3.5)	3,484 (3.6)	0.8%	10,922 (11.3)	11,097 (11.4)	0.4%	5,589 (5.8)	5,586 (5.7)	−1.2%
4. Fibromyalgia	8,005 (87.0)	8,524 (86.5)	−0.5%	314 (3.4)	346 (3.5)	−	883 (9.6)	981 (10.0)	−	498 (5.4)	597 (6.1)	−
5. Headache	16,053 (80.7)	16,907 (80.4)	− 0.4%	804 (4.0)	935 (4.6)	−	3,0 29 (15.2)	3,1 88 (15.2)	0.0 %	1,7 68 (8.9)	1,8 73 (8.9)	0.0 %
6. Orofacial, ear, and temporomandibular disorder pain	3,249 (82.6)	2,069 (83.9)	1.6%	141 (3.6)	97 (3.9)	−	545 (13.9)	300 (12.2)	−	304 (7.7)	173 (7.0)	−
7. Abdominal and bowel pain	24,940 (82.7)	29,525 (82.3)	−0.4%	1,074 (3.6)	1,370 (3.8)	7.3%	4,146 (13.8)	4,970 (13.9)	0.8%	2,506 (8.3)	3,010 (8.4)	1.2%
8. Urogenital, pelvic and menstrual pain	9,396 (80.0)	8,260 (78.8)	−1.5%	542 (4.6)	490 (4.7)	−	1,812 (15.4)	1,735 (16.6)	7.3%	1,147 (9.8)	1,124 (10.7)	9.2%
9. Musculoskeletal chest pain	15,526 (83.9)	17,892 (82.8)	−1.3%	676 (3.7)	884 (4.1)	−	2,314 (12.5)	2,842 (13.2)	5. 2%	1,254 (6.8)	1,445 (6.7)	−1.5%
10. Neuropathy	15,678 (89.8)	15,792 (89.5)	−0.3%	547 (3.3)	594 (3.4)	−	1,241 (7.1)	1,261 (7.2)	0.6%	699 (4. 0)	705 (4. 0)	−
11. Systemic disorders or diseases causing pain	4,030 (86.0)	4,438 (85.4)	−0.8%	255 (5. 4)	298 (5.7)	−	400 (8. 5)	464 (8.9)	−	232 (5.0)	250 (4.8)	−
12. Other painful conditions	19,087 (88.8)	22,892 88.2)	−0.7%	886 (4.1)	1,008 (3.9)	−	1,518 (7.1)	2,056 (7.9)	11.3%	787 (3.7)	1,106 (4.3)	−
All people with encounters with pain diagnosis in clusters 1–12	136,340 (84.1)	137,962 (83.9)	−0.2%	5,612 (3. 5)	5,828 (3.6)	2.9%	20,094 (12.4)	20,605 (12.5)	0.8%	10,501 (6.5)	10,749 (6.5)	0.0%
13. Fractures, contusions, sprains and strains	18,983 (85.1)	25,440 (84.6)	−0.6%	748 (3.4)	1,079 (3.6)	−	2,566 (11.5)	3,561 (11.8)	2.6%	1,439 (6.5)	1,958 (6.5)	0.0%
No pain-related health care encounters	**85,335 (81.4)**	**82,750 (81.7)**	**0.4%**	**3,105 (3.0)**	**2,865 (2.8)**	**−6.7%**	**16,432 (15.7)**	**15,725 (15.5)**	**−1.3%**	**7,044 (6.7)**	**6,708 (6.6)**	**−1.5%**

	KPNW Population (N=270,595)											
	Race, N (% of Total Population in Pain Condition Cluster)									Hispanic Ethnicity, N (%of Total Population in Pain Cluster)		
	White			Black or African Amercan			Other					
	ICD-9-C	ICD-10-CM	% Change	ICD-9-CM	IC % D-C1h	% Change	ICD-9-CM	ICD-10-CM	% Change	ICD-9-C	ICD-10-CM	% Change
	Group Health Population (N=202,777)											
1. Back pain	37,387 (79.4)	35,954 (79.1)	−0.4%	2,282 (4.9)	2,135 (4.7)%	−4.1%	7,427 (15.8)	7,373 (16.2)	2.5%	2,318 (4.9)	2,242 (4.9)	0.0%
2. Neck pain	19,665 (78.2)	19,130 (78.8)	0.8%	1,131 (4.5)	1,028 (4.2)	−6.7%	4,341 (17.3)	4,128 (17.0)	−1.7%	1,275 (5.1)	1,241 (5.1)	0.0%
3. Limb/extremity pain, joint pain and non−systemic, non −inflammatory arthritic disorders	61,574 (79.8)	60,571 (79.7)	−0.1%	3,747 (4.9)	3,639 (4.8)	−2.0%	11,834 (15.3)	11,823 (15.6)	2.0%	3,599 (4.7)	3,585 (4.7)	0.0%
4. Fibromyalgia	5,731 (80.2)	5,974 (80.9)	0.9%	343 (4.8)	316 (4.3)	−	1,070 (15.0)	1,091 (14.8)	−1.3%	384 (5.5)	352 (4.8)	−
5. Headache	12,823 (76.1)	11,961 (75.9)	−0.3%	938 (5.6)	852 (5.4)	−	3,0 96 (18.4)	2,9 43 (18.7)	1.6 %	1,0 33 (6.1)	967 (6.1)	−
6. Orofacial, ear, and temporomandibular disorder pain	2,626 (77.7)	2,091 (77.6)	−0.1%	143 (4.2)	132 (4.9)	−	610 (18.1)	473 (17.5)	−	197 (5.8)	147 (5.5)	−
7. Abdominal and bowel pain	22,134 (78.0)	22,128 (78.3)	0.4%	1,481 (5.2)	1,437 (5.1)	−1.9%	4,761 (16.8)	4,684 (16.6)	−1.2%	1,630 (5.7)	1,559 (5.5)	−3.5%
8. Urogenital, pelvic and menstrual pain	6,148 (74.6)	4,871 (75.5)	1.2%	519 (6.3)	397 (6.2)	−	1,572 (19.1)	1,184 (18.4)	−3.7%	551 (6.7)	402 (6.2)	−
9. Musculoskeletal chest pain	15,826 (78. 1)	15,749 (77.7)	−0.5%	1,085 (5.4)	1,023 (5.1)	−5.6%	3,357 (16.6)	3,497 (17.3)	4.2%	1,021 (5. 0)	1,053 (5.2)	4.0%
10. Neuropathy	12,664 (83.0)	13,362 (83.1)	0.1%	746 (4. 9)	763 (4. 7)	−	1,848 (12.1)	1,964 (12.2)	0.8%	563 (3. 7)	599 (3. 7)	−
11. Systemic disorders or diseases causing pain	3,380 (79.1)	3,127 (79.4)	0.4%	301 (7.1)	254 (6. 5)	−	591 (13.8)	558 (14.2)	2.9%	223 (5.2)	208 (5.3)	−
12. Other painful conditions	17,016 (83.2)	22,269 (81.6)	−1.9%	919 (4.5)	1,258 (4.6)	−	2,520 (12.3)	3,763 (13.8)	12.2%	944 (4.6)	1,265 (4.6)	0.0%
All people with encounters with pain diagnosis in clusters 1–12	99,107 (78.5)	98,445 (78.5)	0.0%	6,255 (5.0)	6,140 (4.9)	−2.0%	20,862 (16.5)	20,819 (16.6)	0.6%	6,184 (4.9)	6,164 (4.9)	0.0%
13. Fractures, contusions, sprains and strains	24,085 (80.2)	26,031 (80.1)	−0.1%	1,463 (4.9)	1,573 (4.8)	−2.0%	4,483 (14.9)	4,902 (15.1)	1.3%	1,468 (4. 9)	1,626 (5.0)	2.0%
No pain-related health care encounters	**54,671 (74.5)**	**54,593 (74.5)**	**0.0%**	**3,294 (4.5)**	**3,359 (4.6)**	**2.2%**	**15,408 (21.0)**	**15,330 (20.9)**	**−0.5%**	**3,543 (4. 8)**	**3,524 (4.8)**	**0.0%**
	VHA Population (N=433,072)											

	KPNW Population (N=270,595)											
	Race, N (% of Total Population in Pain Condition Cluster)									Hispanic Ethnicity, N (%of Total Population in Pain Cluster)		
	White			Black or African Amercan			Other					
	ICD-9-C	ICD-10-CM	% Change	ICD-9-CM	IC % D-C1h	% Change	ICD-9-CM	ICD-10-CM	% Change	ICD-9-C	ICD-10-CM	% Change
1. Back pain	94,035 (61.1)	87,847 (60.6)	−0.8%	25,203 (16.4)	24,464 (16.9)	3.0%	34,743 (22.6)	32,592 (22.5)	−0.4%	19,584 (12.7)	18,479 (12.8)	0.8%
2. Neck pain	27,061 (61.9)	23,785 (60.9)	−1.6%	6,768 (15.5)	6,277 (16.1)	3.9%	9,909 (22.7)	9,001 (23.0)	1.3%	5,080 (11.6)	4,531 (11.6)	0.0%
3. Limb/extremity pain, joint pain and non−systemic, non −inflammatory arthritic disorders	107,691 (59.3)	98,957 (58.7)	−1.0%	33,353 (18.4)	31,821 (18.9)	2.7%	40,674 (22.4)	37,699 (22.4)	0.0%	21,757 (12.0)	20,212 (12.0)	0.0%
4. Fibromyalgia	5,140 (60.1)	5,237 (59.0)	−1.8%	1,416 (16.6)	1,605 (18.1)	9.0%	1,991 (23.3)	2,036 (22.9)	−1.7%	1,019 (11.9)	1,080 (12.2)	2.5%
5. Headache	38,702 (59.3)	34,132 (58.6)	−2.0%	11,933 (18.3)	11,044 (19.0)	3.8 %	14,667 (22.5)	13,102 (22.5)	0.0 %	7,7 94 (11.9)	7,1 91 (12.3)	3.4 %
6. Orofacial, ear, and temporomandibular disorder pain	2,662 (60.6)	1,906 (60.7)	0.2%	713 (16.2)	569 (18.1)	−	1,016 (23.1)	667 (21.2)	−	593 (13.5)	376 (12.0)	−
7. Abdominal and bowel pain	24,145 (63.9)	22,736 (64.1)	0.3%	5,590 (14.8)	5,260 (14.8)	0.0%	8,082 (21.4)	7,500 (21.1)	−1.4%	4,506 (11.9)	4,310 (12.1)	1.7%
8. Urogenital, pelvic and menstrual pain	5,560 (57.6)	4,551 (56.1)	−2.6%	2,045 (21.2)	1,836 (22.6)	6.6%	2,048 (21.2)	1,728 (21.3)	0.5%	1,210 (12.5)	1,009 (12.4)	−0.8%
9. Musculoskeletal chest pain	11,000 (58.9)	10,829 (57.6)	−2.2%	3,604 (19.3)	3,854 (20.5)	6.2%	4,068 (21.8)	4,107 (21.9)	0.5%	2,319 (12.4)	2,243 (12.5)	0.8%
10. Neuropathy	6,473 (59.0)	5,678 (57. 5)	−2.5%	1,981 (18.0)	1,918 (19.4)	7.8%	2,526 (23.0)	2,287 (23.1)	−0.4%	1,235 (11. 2)	1,057 (10.7)	−4.5%
11. Systemic disorders or diseases causing pain	1,971 (47.9)	1,578 (51.1)	6.7%	1,052 (25.6)	751 (24.3)	−	1,090 (26. 5)	757 (24.5)	−	548 (13.3)	339 (11.0)	−
12. Other painful conditions	22,442 (58.3)	27,183 (59.5)	2.1%	7,409 (19.3)	8,249 (18.1)	−6.2%	8,622 (22.4)	10,281 (22.5)	0.4%	4,378 (11.4)	5,332 (11.7)	2.6%
All people with encounters with pain diagnosis in clusters 1–12	178,798 (60.9)	172,694 (60.5)	−0.7%	50,266 (17.1)	49,750 (17.4)	1.8%	64,679 (22.0)	62,856 (22.0)	0.0%	34,585 (11.8)	33,744 (11.8)	0.0%
13. Fractures, contusions, sprains and strains	23,690 (64.3)	17,201 (64.1)	−0.3%	5,825 (15.8)	4,243 (15.8)	0.0%	7,319 (19.9)	5,398 (20.1)	1.0%	4,550 (12.4)	3,221 (12.0)	−3.2%
No pain-related health care encounters	**85,919 (63.8)**	**92,902 (64.3)**	**0.8%**	**21,501 (16.0)**	**22,202 (15.4)**	**−3.8%**	**27,286 (20.3)**	**29,323 (20.3)**	**0.0%**	**14,075 (10.5)**	**15,038 (10.4)**	**−1.0%**