HHS Public Access

Author manuscript

Pharmacoepidemiol Drug Saf. Author manuscript; available in PMC 2018 November 01.

Published in final edited form as:

Pharmacoepidemiol Drug Saf. 2018 May ; 27(5): 495–503. doi:10.1002/pds.4322.

Patterns of Opioid Initiation at First Visits for Pain in United States Primary Care Settings

Mallika L. Mundkur, MD MPH[1], **Kathryn Rough, ScD**[1], **Krista F. Huybrechts, PhD**[1], **Raisa Levin, MS**[1], **Joshua J Gagne, PharmD, ScD**[1], **Rishi J. Desai, PhD**[1], **Elisabetta Patorno, MD DrPH**[1], **Niteesh K. Choudhry, MD PhD**[1], and **Brian T. Bateman, MD MS**[1]

[1]Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine, Brigham and Women's Hospital, Boston, MA

Abstract

Purpose—The primary objective of this study was to characterize variation in patterns of opioid prescribing within primary care settings at first visits for pain, and to describe variation by condition, geography and patient characteristics.

Methods—2014 administrative data from the Optum's Clinformatics™ DataMart were used to evaluate individuals 18 years or older with an initial presentation to primary care for one of ten common pain conditions. The main outcomes assessed were (1) the proportion of first visits for pain associated with an opioid prescription fill and (2) the proportion of opioid prescriptions with >7 days' supply

Results—We identified 205,560 individuals who met inclusion criteria; 9.1% of all visits were associated with an opioid fill, ranging from 4.1% (headache) to 28.2% (dental pain). Approximately half (46%) of all opioid prescriptions supplied more than 7 days and 10% of prescriptions supplied ≥30 days. We observed a four-fold variation in rates of opioid initiation by state, with highest rates of prescribing in Alabama (16.6%) and lowest rates in New York (3.7%).

Conclusions—In 2014, nearly half of all patients filling opioid prescriptions received more than 7 days of opioids in an initial prescription. Policies limiting initial supplies will likely have a substantial impact on opioid prescribing in the primary care setting.

Keywords

Opioids; Primary Care; Pain; Health Policy; Epidemiology

Background

In 2014, more than 10 million Americans misused prescription opioids [1]. During the same year, prescription opioids led to approximately 1000 emergency room visits per day, and

Corresponding author: mmundkur1@partners.org.

Conflicts of Interest

The authors declare they have no conflicts of interest.

Ethical Statement

IRB approval was obtained to conduct this work through the Brigham and Women's Institutional Review Board

more than 14,000 deaths [2–5]. Opioid initiation for pain, even when intended for short-term use, may lead to significant drug-drug interactions, future dependence, or diversion [6–14].

Primary care clinicians represent the largest group of opioid prescribers [6]. Accordingly, guidelines recently issued by the Centers for Disease Control and Prevention (CDC) have targeted primary care clinicians as key agents for containing the opioid epidemic [15]. The guidelines specify that primary care clinicians should avoid opioids when possible, and prescribe no more than 7 days of opioids to patients without a prior history of opioid use. Based upon these recommendations, five states have already implemented policies limiting initial opioid supplies to 7 days [16].

Despite the focus of such policies on opioid initiation, and the fact that primary care settings are a major source of prescription opioids, there is a lack of data describing recent patterns of opioid initiation in primary care settings [16–22]. We sought to characterize opioid initiation across a spectrum of pain conditions encountered in primary care settings, to better understand the potential impact of policies directed at the initiation of opioids.

Methods

We used insurance claims data from the Optum Clinformatics™ DataMart (OptumInsight, Eden Prarie, MN), a database derived from commercial insurance claims which contains a combination of inpatient and outpatient claims, pharmacy dispensing information and patient demographics routinely collected during health insurance enrollment [23]. This study included patients with first visits for pain presenting to a primary care setting in 2014 for one of ten conditions commonly managed in primary care settings: back pain with radiculopathy, back pain without radiculopathy, neck pain, joint pain, tendon/bursal pain, muscle strains/sprains, musculoskeletal injury such as ligamentous tears, urinary calculus, headache and dental pain (see Appendix, Table 1 for ICD9 codes). These specific conditions were selected on the basis of occurring frequently within our dataset. We focused on first visits in order to quantify the tendency of primary care clinicians to prescribe opioids at early stages of pain management.

Patients were eligible for inclusion if they were at least 18 years of age at the beginning of the year and had a claim for an outpatient visit with a recorded new diagnosis for one of the pain conditions of interest. Patients were further required to have 6 months of continuous enrollment prior to the outpatient visit for pain, to ensure that the encounter was, in fact, a first visit and for one week after the visit to assess outcomes. We restricted the analysis to visits with primary care clinicians including generalist physicians (e.g. internist, family practitioner), nurse practitioners, or physician assistants in an outpatient setting.

We excluded patients with history of prior opioid fills, admission to hospitals, nursing homes, ambulatory surgical facilities, or hospice/palliative care utilization in the 6 months prior to the outpatient visit of interest. We also excluded patients with a diagnosis of cancer or opioid-abuse/dependence anytime for up to two years prior to the outpatient visit, as these represent more specialized patient populations.

Outcomes

We assessed two main outcomes relating to opioid initiation: 1) the proportion of first visits for a specific pain condition associated with initiation of opioids, determined by the presence of a prescription claim within 1 week of the visit and 2) the proportion of opioid prescriptions providing a supply greater than 7 days, the maximum initial supply as recommended in the CDC guidelines [15] (see Appendix, Table 2 for opioids).

In a post hoc exploratory analysis, we examined an additional outcome of long-term use by condition in relation to days of opioids initially supplied. We limited the cohort to the subset of opioid recipients with at least 1 year of continuous health plan enrollment following the index date. We assessed the proportion who continued to use opioids chronically—which we defined as greater than or equal to a cumulative 180 days of opioid use following the index date [25]. We compared rates of long-term use for patients depending upon duration of the index supply (ie, ≤7 days vs 8 days or more).

Covariates

We extracted information on a number of variables that we anticipated might influence opioid initiation, including geography (i.e. state), demographics (i.e. age, gender), certain chronic medical co-morbidities (i.e. renal disease, COPD or liver disease), and the Charlson comorbidity score. We evaluated any filled prescriptions for an antidepressant, benzodiazepine, muscle relaxant, gabapentanoid, and sedative/hypnotic (e.g. zolpidem) in the month prior to the pain visit. We also assessed for evidence of psychiatric diagnoses (depression, anxiety, psychosis), history of alcohol or substance use disorder, smoking in the previous 6 months.

Analysis

For our main outcomes, we assessed each pain condition individually, as well as overall, and reported the 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} percentiles of variation in the total dose dispensed in milligrams of morphine equivalents (MME) as well as variation in the days of opioid supplied [24]. Using both univariate and multivariable logistic regression models, we evaluated the association between patient- and provider-level factors and odds of opioid initiation and, among those prescribed opioids, the odds of receiving >7 days supply. Adjusted odds ratios (OR) with 95% confidence intervals (CI) summarize the association between opioid prescribing decisions and the covariates above. Finally, we evaluated state-level variation in opioid initiation in our study outcomes using mixed effects regression models that provided adjusted rates of our two primary outcomes by state, accounting for patient case mix, patient/clinician characteristics (fixed effects) and possible clustering by state (random effect).

We also described the association between initial days supplied and chronic opioid use; we dichotomized initial use as ≤ 7 versus 8 days or more, and compared chronic use between the two groups by deriving a risk difference and 95% confidence interval, for each condition.

Results

Of the 12,389,274 individuals in the Optum Research Database during 2014, a total of 205,560 presented to primary care settings with a first visit for pain and met selection criteria (Figure 1). The mean age of the cohort was 44 (SD 13.2); approximately half of encounters involved female patients. Patients were treated by physicians for the majority of visits (97.8%), though for a small number of visits were treated by nurse practitioners or physician assistants.

The overall rate of opioid initiation was 9.1%. Across conditions, we observed substantial variation in rates of initiation, ranging from 4.1% for patients with headache, to 28.4% for patients with dental pain (Table 1). Among patients receiving opioids, the median initial days' supply of opioid was 7 (IQR 5 to 12), with 46% of opioid prescriptions supplying greater than 7 days of opioids in an initial fill. The most frequently dispensed opioid was hydrocodone (57.3%), followed by tramadol (31.9%) and oxycodone (10.2%); codeine and morphine were each dispensed less than 1% of the time.

We identified a number of factors that were independently associated with increased odds of a patient being prescribed an opioid at a first visit for pain (Table 2). Patients with dental pain, for instance, experienced six-fold higher odds of receiving opioids at a first visit for pain relative to patients with joint pain. Recent use of benzodiazepines and sedative hypnotics were also associated with increased odds of receiving opioids at a first visit, as was male gender. Among patients receiving opioids, several factors were significantly associated with increased odds of receiving an initial opioid supply of greater than 7 days, including advanced age and higher comorbidity (Table 3).

We observed wide variation in opioid initiation by state (Figure 2, Panel A), with the highest rates of initiation at first visits for pain occurring in the Southeast; specifically, states with the highest rates of opioid initiation were Alabama (17%), Arkansas (16%) and Mississippi (14%), while the lowest rates of initiation occurred in New York (4%), Connecticut (5%), New Jersey (5%) and Massachusetts (6%) (see Appendix, Table 3 for crude and adjusted rates). For our secondary outcome, Michigan and Nevada were the two states with the highest proportions of initial supplies exceeding 7 days (64% and 62%, respectively (Figure 2, Panel B) (*see* Appendix, Table 4 for crude and adjusted rates).

For some conditions, we observed a significant difference in long-term use in relation to initial days' supplied, with the largest risk differences observed for neck, back and joint pain (Table 4). We observed either small or non-significant associations between initial days' supplied and long-term use for other conditions.

Discussion

Our study represents the most recent, comprehensive, and policy-oriented description of opioid initiation in primary care settings in the United States. From a cohort of 210,017 adults presenting to a primary care setting in a first visit for pain, over twenty thousand patients received opioids at a first visit for pain. When opioids were prescribed, patients received an initial opioid supply exceeding 7 days in nearly half of cases. Our findings

suggest that policies imposing 7-day limits, if implemented nationwide, would have a substantial impact on opioid prescribing patterns.

We observed wide variation in opioid prescribing both within and across conditions that would be reduced by policies limiting initial opioid supplies. While this change might not be beneficial in all situations, it would serve to eliminate certain prescribing practices that might be considered excessive [26]. Specifically, we found that approximately one in ten opioid recipients in our cohort received an opioid supply of 30 days or greater—the equivalent of 80 tablets of 5-mg oxycodone— in an initial prescription. Even for patients initiating treatment for chronic pain, providing such quantities of opioids to patients without prior or recent experience with opioids, such as the individuals in our cohort, may be associated with risks of accidental overdose, misuse by household members, or diversion of leftover medication [27–29]. Thus, conceivable benefits of policies restricting initial supplies might be to eliminate outliers in prescribing, to promote a culture of providing only the minimum necessary, and to cultivate the expectation among patients that pain will need to be assessed more frequently.

While policies enforcing prescribing limits may confer some benefits, limits that are arbitrarily set at a certain value also run the risk of interfering with “best” clinical care [30]. Much of the variation in opioid prescribing that we observed, for example, might be considered appropriate responses to variation in acuity of pain, expected natural history of the condition, or logistical factors affecting patient access (e.g. dependence on others for transportation in the case of elderly or disabled individuals). We also note that the majority of primary care clinicians in our cohort exhibited a generally cautious approach to opioid initiation, and 90% of the time did not prescribe opioids at a first visit for pain. Furthermore, when opioids were selected, most clinicians prescribed no more than 12 days of opioids, and for some conditions as few as 2. It is not surprising, then, that policies strictly enforcing limits on either days or quantities supplied have been met with criticism, particularly given the lack of data to support a using a threshold of 7 days [15, 31]. Policies that rigidly enforce limits without enabling the inclusion of important patient-centric factors may lead to such unintended consequences as an increase in healthcare costs (e.g. increased use of emergency rooms, more frequent office visits), and under-treatment of pain. Finally, tighter restrictions on prescription opioids may feed directly into the growing problem of heroin abuse; New York and Massachusetts, states with the lowest rates of opioid initiation in our study and early adopters of the 7-day limits, have also been among the states to witness the greatest recent rise in heroin-related deaths, with such deaths increasing by 30% in each state over the period 2014–2015 [16, 32].

Apart from the policy implications of our findings, other aspects of our results warrant further exploration. We observed, for instance, that patients with risk factors for developing an opioid use disorder or opioid-related adverse effects (e.g. history of smoking, recent benzodiazepine use) were at higher odds of receiving opioids at a first visit for pain, indicating a potential need to strengthen existing risk assessment protocols in primary care settings [33–37]. We also found that even when adjusting for condition, age and other measured differences, men had a 30% increased odds of receiving opioids at a first visit for pain relative to women, suggesting either objective differences in pain at first presentation or

implicit gender bias in prescribing. We were struck by four-fold geographic variation in opioid initiation by state that persisted even after adjusting for differences such as case-mix. Echoing more general data on prevalent opioid use by state, we observed lowest rates of initiation in the Northeast and highest initiation in the South [38]. Finally, we observed an association between initial days' supplied and long-term opioid use for some conditions though not others. While experts have advocated for limiting the initial supply of opioids dispensed to prevent the development of dependence or addiction, we were not able to describe the clinical factors that account for the pattern observed in our data. It may be explained by prescribing intent at the outset (ie, the clinician's decision to institute opioids as a chronic medication), severity of illness, or unmeasured confounders. Future research will need to further characterize the extent to which limiting the quantity of medication dispensed with the initial opioid prescription decreases chronic opioid use.

Our study has key limitations. First, we were not able to measure or adjust for factors such as pain severity using claims data, which may explain some of the observed variation in opioid- prescribing. However, even self-reported pain-rating scales, the established standard used to quantify pain severity, are often difficult to interpret in the context of inconsistent agreement with objective assessments [39]. Second, given that claims data are available only for prescription drugs, we cannot measure use of over-the-counter medication medications prior to a visit. Third, our sample represents a commercially-insured population that is relatively healthy and young. Therefore, our findings may not generalize to all populations, including the unemployed and the elderly. Finally, by focusing on primary care settings, our study does not clarify prescribing by other major prescribers such as surgeons, dentists and emergency room physicians [6].

The prescribing guidelines issued by the CDC represent the first set of recommendations regarding opioid prescribing that have ever been issued by a national public health agency [15]. Several states have already responded rapidly to these recommendations, and five states in the Northeast – Massachusetts, New York, Connecticut, Maine and Rhode Island – have passed new laws in 2016, limiting initial opioid prescriptions to a maximum of 7 days [16]. As opioid limits are considered in a wider number of states, dramatic changes in prescribing practices in the primary care setting can be anticipated, although the extent of this impact will vary based upon baseline patterns. As health systems implement more restrictive prescribing, measures must simultaneously be undertaken to ensure that individuals with pain are not undertreated [40].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We thank Jerry Avorn, Chana Sacks and Michael Fralick for their feedback on this project.

References

1. Substance Abuse and Mental Health Services Administration [Internet]. Results from the 2014 National Survey on Drug Use and Health: Detailed Tables [updated 2016 Nov 28; cited 2016 Nov 28]. Available from: http://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs2014/NSDUH-DetTabs2014.pdf
2. Centers for Disease Control and Prevention [Internet]. Prescription Opioid Overdose Data [update 2016 Nov 28; cited 2016 Nov 28]. Available from: https://www.cdc.gov/drugoverdose/data/overdose.html
3. Centers for Disease Control and Prevention [Internet]. Injury Prevention and Control: Opioid Overdose—Understanding the Epidemic [updated 2016 Jun 21; cited 2016 Aug 31]. Available from: https://www.cdc.gov/drugoverdose/epidemic/index.html
4. National Institute on Drug Abuse [Internet]. Overdose Death Rates [updated 2015 Dec; cited 2016 Aug 31]. Available from: https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates
5. Bohnert AS, Valenstein M, Bair MJ, et al. Association between opioid prescribing patterns and opioid overdose-related deaths. JAMA. 2011 Apr 6; 305(13):1315–21. DOI: 10.1001/jama.2011.370 [PubMed: 21467284]
6. Volkow ND, McClellan TA, Cotto JH. Characteristics of Opioid Prescriptions in 2009. JAMA. 2011; 305(13):1299–1301. DOI: 10.1001/jama.2011.401 [PubMed: 21467282]
7. Canfield MC, Keller CE, Frydrych LM, Ashrafioun L, Purdy CH, Blondell RD. Prescription opioid use among patients seeking treatment for opioid dependence. J Addict Med. 2010 Jun; 4(2):108–13. DOI: 10.1097/ADM.0b013e3181b5a713 [PubMed: 20543897]
8. Alam A, Gomes T, Zheng H, Mamdani MM, Juurlink DN, Bell CM. Long-term analgesic use after low-risk surgery: a retrospective cohort study. Arch Intern Med. 2012 Mar 12; 172(5):425–30. DOI: 10.1001/archinternmed.2011.1827 [PubMed: 22412106]
9. Bigal ME, Serrano D, Buse D, Scher A, Stewart WF, Lipton RB. Acute migraine medications and evolution from episodic to chronic migraine: a longitudinal population-based study. Headache. 2008 Sep; 48(8):1157–68. DOI: 10.1111/j.1526-4610.2008.01217.x [PubMed: 18808500]
10. Lee M, Silverman SM, Hansen H, Patel VB, Manchikanti L. A comprehensive review of opioid-induced hyperalgesia. Pain Physician. 2011 Mar-Apr;14(2):145–61. [PubMed: 21412369]
11. Copello EA, Kroutil LA. RTI International. Behavioral Health Trends in the United States: Results from the 2014 National Survey on Drug Use and Health. Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services. 2015 Sep. Publication No.: SMA 15-4927. Contract No.: HHSS283201300001C.
12. Substance Abuse and Mental Health Services Administration [Internet]. [cited 2016 Nov 30] Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings. Available from: http://www.samhsa.gov/data/sites/default/files/NSDUHresultsPDFWHTML2013/Web/NSDUHresults2013.htm#2.16
13. United States Food and Drug Administration [Internet]. Medicine Disposal: Question and Answers [updated 2016 Oct 25; cited 2016 Nov 30]. Available from: http://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/EnsuringSafeUseofMedicine/SafeDisposalofMedicines/ucm186188.htm
14. Compton WM, Volkow ND. Major increases in opioid analgesic abuse in the United States: concerns and strategies. Drug Alcohol Depend. 2006 Feb 1; 81(2):103–7. Epub 2005 Jul 14. [PubMed: 16023304]
15. Centers for Disease Control and Prevention. CDC Guideline for Prescribing Opioids for Chronic Pain—United States, 2016. Morbidity and Mortality Weekly Report [Internet]. 2016 Mar; 65(1):1–49. [cited 2016 Aug 31] Available from: https://www.cdc.gov/mmwr/volumes/65/rr/rr6501e1.htm.
16. Pew Charitable Trusts [Internet]. In States, Some Resistance to New Opioid Limits [updated 2016 Jun 28, cited on 2016 Sep 1]. Available at: http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/06/28/in-states-some-resistance-to-new-opioid-limits

17. Deyo RA, Smith DH, Johnson ES,et al. Opioids for back pain patients: primary care prescribing patterns and use of services. J Am Board Fam Med. 2011 Nov-Dec;24(6):717–27. DOI: 10.3122/jabfm.2011.06.100232 [PubMed: 22086815]
18. Dobscha SK, Morasco BJ, Duckart JP, Macey T, Deyo RA. Correlates of prescription opioid initiation and long-term opioid use in veterans with persistent pain. Clin J Pain. 2013 Feb; 29(2): 102–8. DOI: 10.1097/AJP.0b013e3182490bdb [PubMed: 23269280]
19. Sullivan MD, Edlund MJ, Fan MY, Devries A, Brennan Braden J, Martin BC. Trends in use of opioids for non-cancer pain conditions 2000–2005 in commercial and Medicaid insurance plans: the TROUP study. Pain. 2008 Aug 31; 138(2):440–9. Epub 2008 Jun 10. DOI: 10.1016/j.pain.2008.04.027 [PubMed: 18547726]
20. Edlund MJ, Steffick D, Hudson T, Harris KM, Sullivan M. Risk factors for clinically recognized opioid abuse and dependence among veterans using opioids for chronic non-cancer pain. Pain. 2007 Jun; 129(3):355–62. Epub 2007 Apr 20. [PubMed: 17449178]
21. Mafi JN, Edwards ST, Pedersen NP, Davis RB, McCarthy EP, Landon BE. Trends in the ambulatory management of headache: analysis of NAMCS and NHAMCS data 1999–2010. J Gen Intern Med. 2015 May; 30(5):548–55. Epub 2015 Jan 8. DOI: 10.1007/s11606-014-3107-3 [PubMed: 25567755]
22. Mafi JN, McCarthy EP, Davis RB, Landon BE. Worsening trends in the management and treatment of back pain. JAMA Intern Med. 2013 Sep 23; 173(17):1573–81. Erratum in: JAMA Intern Med. 2015 May; 175 (5): 869. DOI: 10.1001/jamainternmed.2013.8992 [PubMed: 23896698]
23. Optum [Internet]. [cited 2016 Nov 29] Optum Clinformatics Data Mart. Available from: https://www.optum.com/content/dam/optum/resources/productSheets/Clinformatics_for_Data_Mart.pdf
24. Centers for Disease Control and Prevention [Internet]. [cited 2016 Nov 22] Calculating Total Daily Dose of Opioids for Safer Dosage. Available from : https://www.cdc.gov/drugoverdose/pdf/calculating_total_daily_dose-a.pdf
25. Barnett ML, Olenksi AR, Jena AB. Opioid Prescribing by Emergency Physicians and Risk of Long-Term Use. N Engl J Med. 2017 May 11.376(19):1896.doi: 10.1056/NEJMc1703338 [PubMed: 28489999]
26. Washington State Medical Association [Internet]. [cited 2016 Dec 27] Washington Emergency Department Opioid Prescribing Guidelines. Available from: http://www.maineacep.org/uploadedFiles/Maine/edopioidabuseguidelinesfinal.pdf
27. Bond GR, Woodward RW, Ho M. The growing impact of pediatric pharmaceutical poisoning. J Pediatr. 2012 Feb; 160(2):265–270. e1. Erratum in: J Pediatr. 2012 May;160 (5): 888–9. DOI: 10.1016/j.jpeds.2011.07.042 [PubMed: 21920539]
28. Gaither JR, Leventhal JM, Ryan SA, et al. National Trends in Hospitalizations for Opioid Poisonings Among Children and Adolescents, 1997 to 2012. JAMA Pediatri. 2016; 170(12):1195–1201.
29. Kennedy-Hendricks A, Gielen A, McDonald E, et al. Medication Sharing, Storage, and Disposal Practices for Opioid Medications Among US Adults. JAMA Intern Med. 2016; 176(7):1027–1029. [PubMed: 27295629]
30. Mundkur ML, Gordon AJ, Kertesz SG. Will Strict Limits on Opioid Prescription Duration Prevent Addiction? Advocating for Evidence-Based Policymaking, Substance Abuse. [insert my recent article/perspective on opioids].
31. Foreman, Judy [Internet]. [cited on 2016 Nov 3] Analysis: Controversy Over CDC's Proposed Opioid Prescribing Guidelines. Available at: http://www.wbur.org/commonhealth/2016/01/09/analysis-controversy-over-cdcs-proposed-opioid-prescribing-guidelines
32. Centers for Disease Control and Prevention [Internet]. Heroin Overdose Data [updated: 2017 Jan 26; cited 2017 Mar 10. Available from: https://www.cdc.gov/drugoverdose/data/heroin.html
33. Liu Y, Logan JE, Paulozzi LJ, Zhang K, Jones CM. Potential misuse and inappropriate prescription practices involving opioid analgesics. Am J Manag Care. 2013 Aug; 19(8):648–65. [PubMed: 24304213]
34. U.S. Food and Drug Administration [Internet]. FDA News Release: FDA requires strong warnings for opioid analgesics, prescription opioid cough products, and benzodiazepine labeling related to serious risks and death from combined use [updated 2016, Aug 31; cited 2016 Nov 29].

35. Warner M, Chen LH, Makuc DM. Increase in fatal poisonings involving opioid analgesics in the United States: 1999–2006. NCHS Data Brief. 2009 Sep.(22):1–8.

36. Webster LR, Cochella S, Dasgupta N, et al. An analysis of the Root Causes for Opioid-Related Overdose Deaths in the United States. Pain Medicine. 2011 Jun.(12):S26–S35. [PubMed: 21668754]

37. Hooten WM, St Sauver JL, McGree ME, Jacobson DJ, Warner DO. Incidence and Risk Factors for Progression from Short-Term to Episodic or Long-term Opioid Prescribing. Mayo Clinic Proceedings. 2015 Jul; 90(7):850–856. [PubMed: 26141327]

38. Paulozzi LJ, Mack KA, Hockenberry JM. Vital signs: variation among States in prescribing of opioid pain relievers and benzodiazepines - United States, 2012. MMWR Morb Mortal Wkly Rep. 2014 Jul 4; 63(26):563–8. [PubMed: 24990489]

39. Williamson A1, Hoggart B. Pain: a review of three commonly used pain rating scales. Clin Nurs. 2005 Aug; 14(7):798–804.

40. Bateman BT, Choudhry NK. Limiting the Duration of Opioid Prescriptions: Balancing Excessive Prescribing and the Effective Treatment of Pain. JAMA Intern Med. 2016 May 1; 176(5):583–4. DOI: 10.1001/jamainternmed.2016.0544 [PubMed: 27043188]

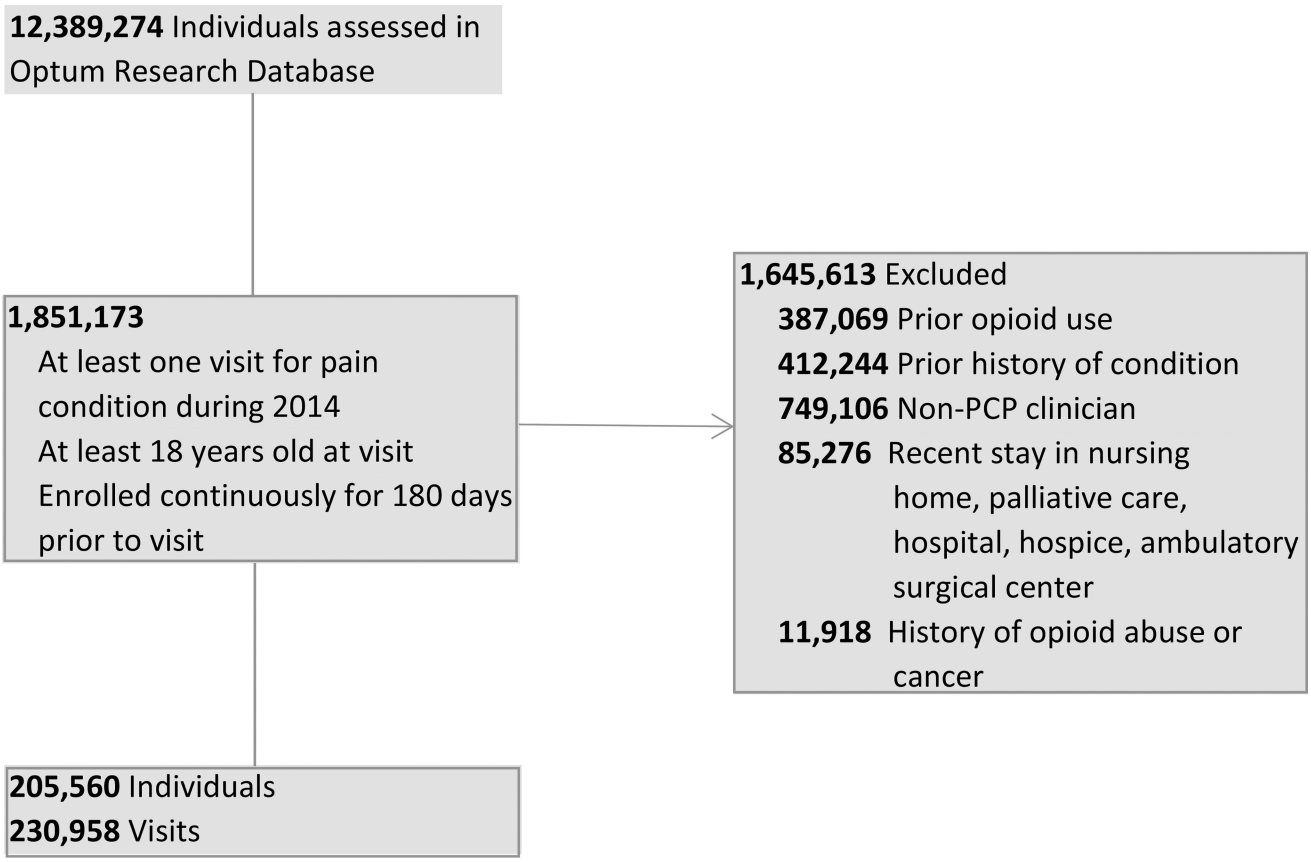
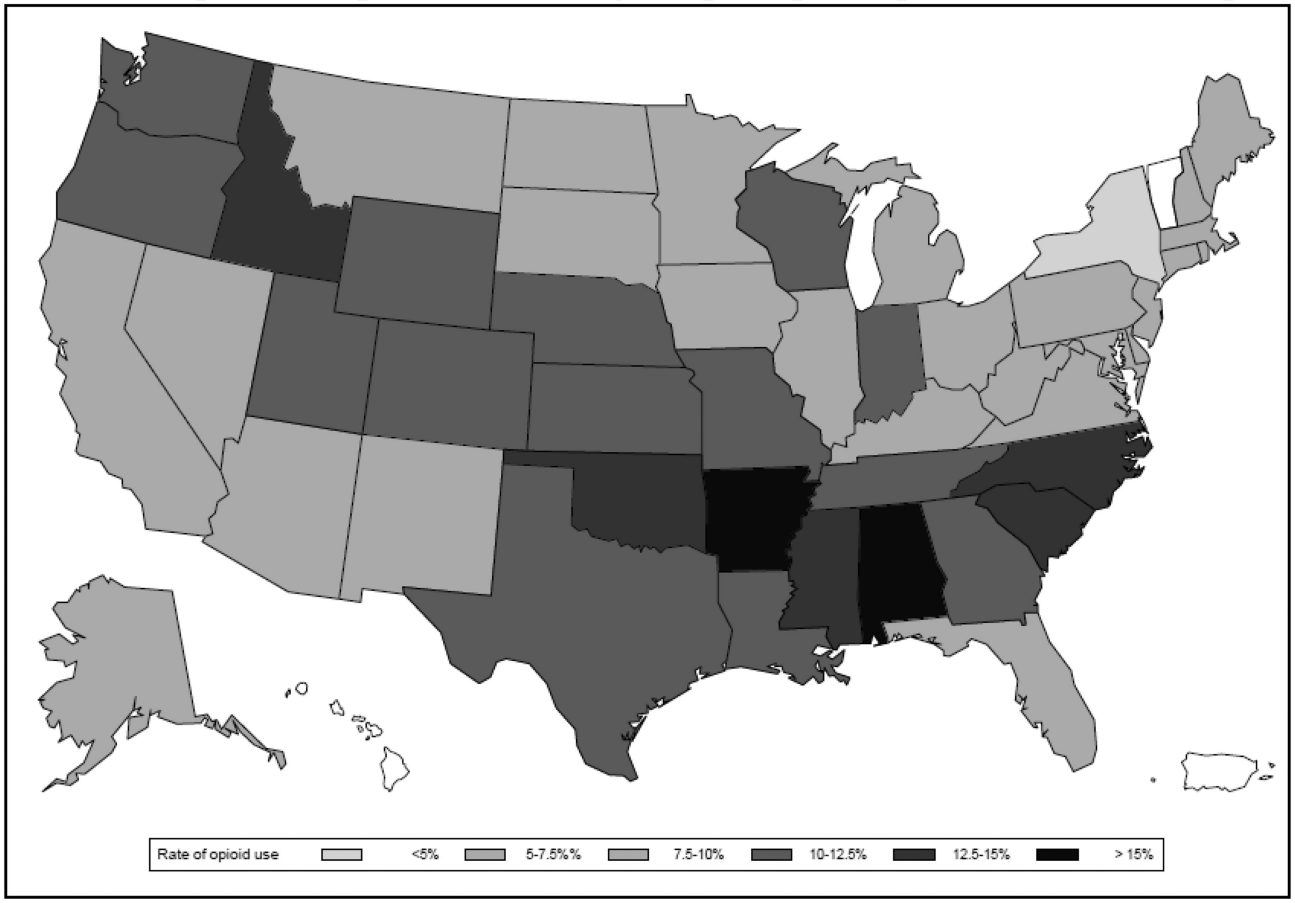


Figure 1.
Selection of Patients into Cohort from Optum Clinformatics™ DataMart, 2014

Panel A. Proportion of patients receiving an opioid prescription at first visit for pain*



Panel B. Proportion of opioid recipients receiving greater than a 7 day supply*

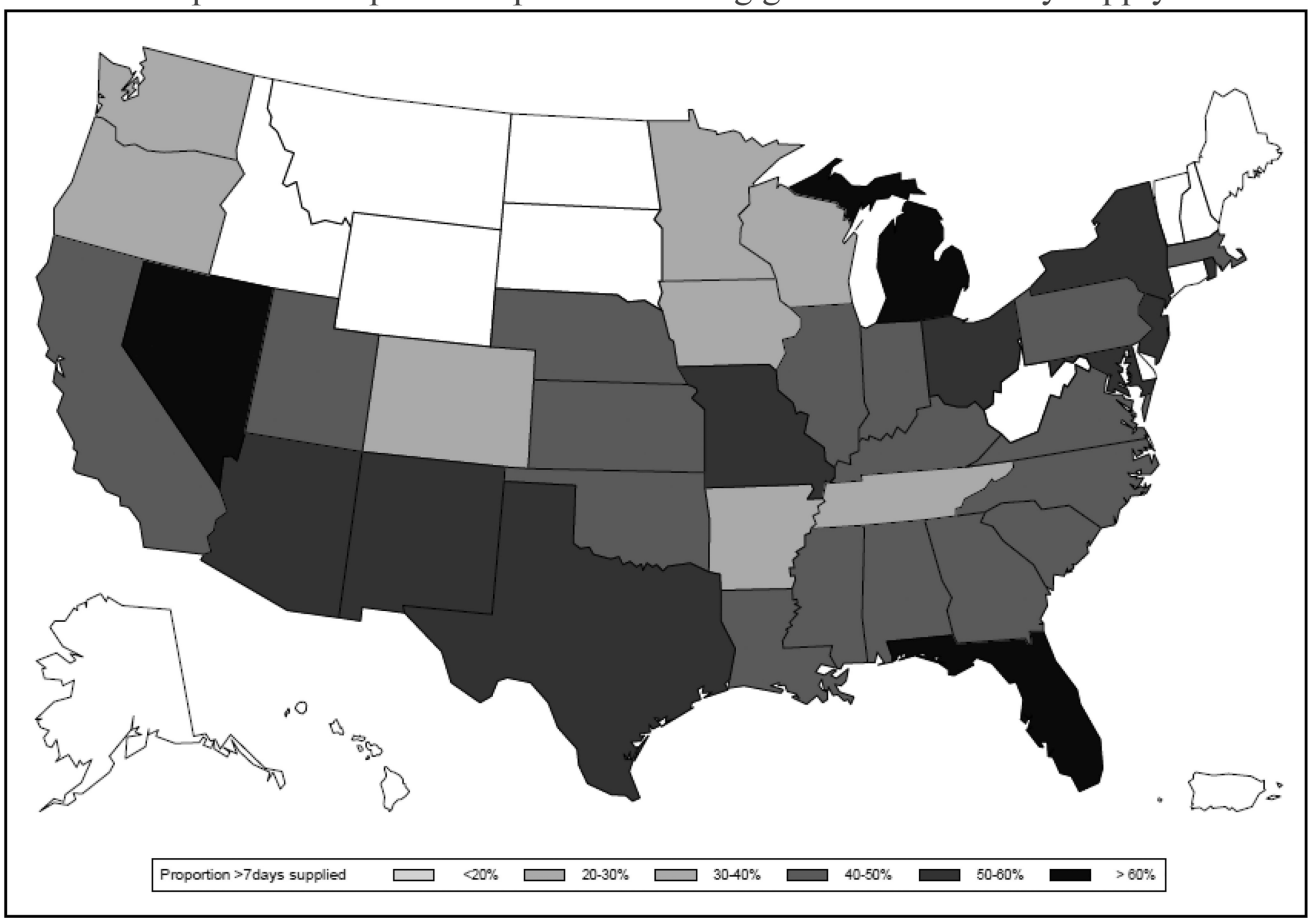


Figure 2.

2014 Geographic Variation: Opioid Prescribing at First Visits for Pain in Primary Care Settings

*Estimates adjust for both fixed effects (e.g. case-mix, patient demographics/comorbidities, clinician type and all other factors outlined in Tables 2 and 3) as well as random effects (i.e. clustering of outcomes by state). If number of encounters < 100, estimates suppressed

Table 1

Frequency of opioid prescribing and quantity prescribed by primary care clinicians for 10 pain conditions in 2014

	Initial pain encounters	Initial pain encounters with opioid fill*	Days of opioid supplied**	Total mg morphine equivalents**
	n	% (95% CI)	Median [10th, 25th, 75th 90th percentile]	Median [10th, 25th, 75th, 90th percentile]
All conditions	230,958	9.1 (9.0–9.1)	7 [3, 5, 12, 30]	150 [90, 120, 300, 600]
Joint pain	71,735	6.6 (6.4–6.7)	8 [3, 5, 15, 30]	150 [100, 150, 300, 450]
Back pain without radiculopathy	54,682	14.5 (14.3–14.9)	7 [3, 5, 12, 25]	150 [90, 113, 300, 450]
Headache	40,005	4.1 (4.0–4.4)	7 [3, 4, 12, 24]	150 [75, 100, 300, 600]
Neck pain	18,957	10.2 (9.8–10.6)	7 [3, 5, 12, 23]	150 [75, 102, 300, 450]
Tendonitis/ Bursitis	18,888	4.9 (4.6–5.3)	7 [3, 5, 13, 30]	150 [90, 120, 300, 450]
Muscular strains/sprains	12,763	10.0 (9.5–10.5)	5 [3, 5, 8, 15]	150 [75, 100, 200, 300]
Back pain with radiculopathy	6,983	20.2 (19.3–21.2)	7 [3,5, 13, 30]	158 [100, 150, 300, 450]
Nephrolithiasis	3,593	15.3 (14.2–16.5)	5 [3, 3, 8, 15]	150 [75, 100, 225, 338]
Musculoskeletal injury	2,153	7.9 (6.8–9.1)	7 [3, 4, 10, 20]	200 [100, 150, 300, 450]
Dental pain	1,199	28.4 (25.9–30.1)	4 [2, 3, 7, 10]	100 [60, 75, 150, 225]

*Opioid fill occurred within 1 week of pain encounter

**Limited to patients with opioid fill

Table 2

Characteristics of outpatient visits for pain and odds of filling an opioid prescription within 1 week

	Initial pain encounters without opioid fill (N = 210,017)	Initial pain encounters with opioid fill (N = 20,941)	Univariate analysis: opioid fill	Multivariable analysis: opioid fill
	%	%	OR (95% CI)	OR (95% CI)
Condition				
Joint pain	31.9	22.5	Ref	Ref
Back pain without radiculopathy	22.3	38.0	2.42 (2.33, 2.52)	1.65 (1.58, 1.72)
Headache	18.3	8.0	0.62 (0.59, 0.66)	0.63 (0.59, 0.67)
Neck pain	8.1	9.2	1.61 (1.53, 1.71)	1.08 (1.02, 1.15)
Tendonitis/ Bursitis	8.6	4.5	0.74 (0.69, 0.80)	0.75 (0.69, 0.80)
Muscular strains/sprains	5.5	6.1	1.58 (1.48, 1.68)	1.51 (1.41, 1.61)
Back pain with radiculopathy	2.7	6.7	3.61 (3.38, 3.85)	2.57 (2.40, 2.75)
Nephrolithiasis	1.5	2.6	2.57 (2.34, 2.83)	2.66 (2.41, 2.93)
Musculoskeletal injury	0.9	0.8	1.21 (1.03, 1.42)	1.28 (1.09, 1.50)
Dental pain	0.4	1.6	5.64 (4.96, 6.41)	5.97 (5.24, 6.80)
Clinician type				
Physician	97.9	97.0	Ref	Ref
Nurse Practitioner	1.9	2.6	1.41 (1.29, 1.55)	1.29 (1.18, 1.42)
Physician's Assistant	0.3	0.4	1.68 (1.34, 2.10)	1.55 (1.22, 1.96)
Patient demographics				
Age (years)				
18–45	51.7	51.0	Ref	Ref
46–55	26.0	27.8	1.09 (1.05, 1.12)	1.07 (1.04, 1.11)
56–65	18.9	18.4	0.99 (0.95, 1.03)	0.99 (0.95, 1.03)
>65	3.4	2.9	0.87 (0.80, 0.94)	0.93 (0.85, 1.01)
Male	48.9	56.1	1.34 (1.30, 1.38)	1.26 (1.22, 1.30)
Other medications (in one month prior to index visit)				
Antidepressants	6.1	7.2	1.18 (1.12, 1.25)	1.15 (1.08, 1.22)
Benzodiazepines	3.3	6.4	1.99 (1.87, 2.11)	2.01 (1.87, 2.15)
Gabapentin	0.9	1.7	1.95 (1.74, 2.19)	1.57 (1.39, 1.77)
Muscle relaxants	9.5	32.4	4.56 (4.41, 4.71)	3.67 (3.54, 3.80)
Sedative hypnotic	2.4	2.8	1.20 (1.10, 1.30)	1.23 (1.12, 1.35)
Chronic diseases (in 180 days prior to visit)				
COPD/Asthma	5.9	6.1	1.05 (0.99, 1.11)	0.98 (0.92, 1.05)
Liver disease	1.0	0.8	0.81 (0.70, 0.95)	0.79 (0.67, 0.93)
Renal disease	1.1	1.3	1.23 (1.08, 1.40)	1.16 (0.99, 1.35)
Psychiatric disorders (in 180 days prior to visit)				

	Initial pain encounters without opioid fill (N = 210,017)	Initial pain encounters with opioid fill (N = 20,941)	Univariate analysis: opioid fill	Multivariable analysis: opioid fill
	%	%	OR (95% CI)	OR (95% CI)
Anxiety	6.4	6.5	1.01 (0.95, 1.07)	0.88 (0.83, 0.94)
Psychosis	0.2	0.1	0.74 (0.49, 1.13)	0.72 (0.47, 1.10)
Depression	6.0	6.1	1.02 (0.96, 1.08)	0.97 (0.91, 1.04)
Non-prescription drug use(in 180 days prior to visit)				
Smoking	2.4	3.1	1.34 (1.24, 1.46)	1.23 (1.13, 1.34)
Alcohol Abuse/dependence	0.3	0.5	1.43 (1.17, 1.76)	1.25 (1.00, 1.55)
Drug abuse	0.1	0.2	1.24 (0.87, 1.77)	1.05 (0.72, 1.52)
Charlson Comorbidity Score				
0	86.9	86.2	Ref	Ref
1	10.6	11.1	1.06 (1.01, 1.10)	1.09 (1.03, 1.15)
2	1.9	2.1	1.11 (1.00, 1.23)	1.08 (0.97, 1.21)
3 +	0.5	0.6	1.19 (0.99, 1.43)	1.13 (0.91, 1.41)

Table 3

Characteristics of initial encounters for pain resulting in >7 days opioid supply*

	Initial pain encounters with ≤7 days of opioid supplied (N = 11,273)	Initial pain encounters with >7 days of opioid supplied (N = 9,668)	Univariate analysis: >7 days of opioid supplied	Multivariable analysis: >7 days opioid supplied
	%	%	OR (95% CI)	OR (95% CI)
Condition				
Joint pain	19.7	25.7	Ref	Ref
Back pain without radiculopathy	37.3	38.8	0.80 (0.74, 0.86)	0.94 (0.87, 1.01)
Headache	8.4	7.5	0.68 (0.61, 0.76)	0.74 (0.66, 0.83)
Neck pain	9.2	9.2	0.77 (0.69, 0.85)	0.91 (0.82, 1.02)
Tendonitis/ Bursitis	4.4	4.5	0.78 (0.68, 0.90)	0.80 (0.69, 0.92)
Muscular strains/sprains	7.9	3.9	0.38 (0.33, 0.43)	0.42 (0.37, 0.48)
Back pain with radiculopathy	6.3	7.2	0.87 (0.77, 0.98)	0.97 (0.85, 1.09)
Nephrolithiasis	3.4	1.7	0.38 (0.32, 0.46)	0.38 (0.32, 0.47)
Musculoskeletal injury	0.8	0.8	0.80 (0.59, 1.09)	0.81 (0.60, 1.11)
Dental pain	2.5	0.6	0.18 (0.13, 0.24)	0.20 (0.15, 0.26)
Clinician type				
Physician	96.4	97.6	Ref	Ref
Nurse Practitioner	3.0	2.1	0.69 (0.58, 0.82)	0.72 (0.60, 0.87)
Physician's Assistant	0.5	0.3	0.56 (0.36, 0.87)	0.57 (0.36, 0.90)
Patient demographics				
Age (years)			-	-
18–45	56.2	44.9	Ref	Ref
46–55	25.7	30.2	1.47 (1.38, 1.57)	1.35 (1.26, 1.44)
56–65	16.0	21.1	1.65 (1.54, 1.78)	1.41 (1.31, 1.52)
>65	2.12	3.9	2.29 (1.93, 2.70)	1.79 (1.51, 2.13)
Male *(% visits)*	55.7	56.7	1.04 (0.98, 1.10)	1.07 (1.01, 1.13)
Other medications (in one month prior to index visit)				
Antidepressants	6.8	7.6	1.12 (1.01, 1.24)	1.04 (0.92, 1.16)
Benzodiazepines	5.7	7.1	1.26 (1.13, 1.41)	1.12 (0.99, 1.26)
Gabapentin	1.3	2.2	1.71 (1.38, 2.12)	1.34 (1.08, 1.67)
Muscle relaxants	34.7	29.6	0.79 (0.75, 0.84)	0.74 (0.70, 0.79)
Sedative hypnotic	2.4	3.3	1.35 (1.15,1.59)	1.26 (1.07, 1.50)
Chronic diseases (in 180 days prior to visit)				
COPD/Asthma	5.5	6.9	1.27 (1.27, 1.44)	0.87 (0.77, 1.00)
Liver disease	0.6	1.1	1.76 (1.29, 2.39)	1.36 (0.98, 1.87)
Renal disease	0.9	1.8	2.13 (1.66, 2.74)	1.35 (1.00, 1.81)
Psychiatric disorders (in 180 days prior to visit)				

	Initial pain encounters with ≤7 days of opioid supplied (N = 11,273)	Initial pain encounters with >7 days of opioid supplied (N = 9,668)	Univariate analysis: >7 days of opioid supplied	Multivariable analysis: >7 days opioid supplied
	%	%	OR (95% CI)	OR (95% CI)
Anxiety	6.0	7.1	1.21 (1.09, 1.35)	1.18 (1.05, 1.34)
Psychosis	0.1	0.1	0.83 (0.37, 1.88)	0.82 (0.35, 1.90)
Depression	6.1	6.2	1.01 (0.90, 1.13)	0.93 (0.82, 1.06)
Non-prescription drug use(in 180 days prior to visit)				
Smoking	2.8	3.6	1.30 (1.11, 1.52)	1.20 (1.02, 1.40)
Alcohol	0.5	0.5	1.10 (0.75, 1.62)	0.88 (0.59, 1.31)
Drug abuse	0.2	0.2	1.16 (0.59,2.29)	1.10 (0.55, 2.19)
Charlson Comorbidity Score				
0	89.3	82.5	Ref	Ref
1	8.8	13.8	1.70 (1.56,1.86)	1.55 (1.40, 1.71)
2	1.5	2.8	2.00 (1.65, 2.43)	1.54 (1.24, 1.91)
3 +	0.4	0.9	2.75 (1.89, 4.00)	1.81 (1.18, 2.76)

* Restricted to pain visits with opioid fill within 1 week

Table 4

Long-term opioid use and number of opioid refills in the 1 year following index opioid fill *

	Long-term use among individuals with initial opioid fill ≤7 days **	Long-term use among individuals with initial opioid fill >7 days **	Risk Difference (95% CI)
	Proportion (%)	Proportion (%)	%
Joint pain	16/1557 (1.0)	90/1751 (5.1)	4.1 (3.0, 5.3)
Back pain without radiculopathy	47/2955 (1.6)	151/2619 (5.8)	4.2 (3.2, 5.2)
Headache	1/642 (0.2)	10/496 (2.0)	1.8 (0.6, 3.5)
Neck pain	9/709 (1.3)	46/605 (7.6)	6.3 (4.2, 8.8)
Tendonitis/ Bursitis	4/345 (1.2)	14/304 (4.6)	3.4 (0.8, 6.5)
Muscular strains/sprains	1/630 (0.2)	5/263 (1.9)	1.7 (0.4, 4.2)
Back pain with radiculopathy	9/489 (1.8)	36/500 (7.2)	5.4 (2.8, 8.1)
Nephrolithiasis	0/277 (0)	2/120 (1.7)	1.7 (−0.1, 5.9)
Musculoskeletal injury	1/64 (1.6)	1/52 (1.9)	0.3 (−7.8, 10.1)
Dental pain	1/189 (0.5)	0/42 (0)	−0.5 (−9.9, 3.4)

* among opioid recipients only and patients with at least 365 days of continuous enrollment following the index fill

** long-term use defined as ≥180 days of opioid use