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Evaluation and Treatment Patterns of New Low Back Pain Episodes for Elderly Adults in the United States, 2011-2014

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Abstract

Introduction: New low back pain (LBP) is a common outpatient complaint. Little is known about how care is delivered over the course of a year to patients who develop new LBP and whether such care patterns are guideline-concordant.

Methods: This retrospective analysis included Medicare claims of 162,238 opioid-naïve beneficiaries with new LBP from January 1, 2011, through December 31, 2014. Simple rates of modality use (computed tomography [CT] and magnetic resonance imaging [MRI] ["advanced imaging"], physical therapy [PT], opioid and non-opioid medications) and percentiles (5^{th} percentile, 25^{th} percentile, median, 75 percentile, and 95^{th} percentile) were reported.

Results: Within the first year, 29.4% (95% confidence interval [CI] 29.1-29.8) of patients with two or more visits for new LBP received advanced imaging, and 48.4% (95% CI 47.7-49.0) of these patients received advanced imaging within 6 weeks of the first visit. 17.3% (95% CI 17.1-17.6) of patients with two or more visits received PT. 42.2% (95% CI 41.8-42.5) of patients with two or more visits received nonsteroidal anti-inflammatory drugs (NSAIDs), 16.9% (95% CI 16.6-17.1) received a muscle relaxant, and 26.2% (95% CI 25.9-26.6) received tramadol. 32.3% (95% CI 31.9-32.6) of patients with two or more visits received opioids; 52.4% (95% CI 51.7-53.0) of these patients had not received a prescription NSAID and 82.2% (95%CI 81.7-82.7) of these patients had not received PT.

Conclusions: Many patients who develop new LBP receive guideline non-concordant care such as early advanced imaging and opioids before other modalities like PT and prescription NSAIDs.

Keywords

low back pain; opioids; advanced imaging; physical therapy

Introduction

New low back pain (LBP) is a common outpatient complaint,[1] and the 1-year incidence of new LBP is approximately 10 percent.[2] Many cases of new LBP are self-limiting, but some patients may develop chronic LBP.[3] Patients with new LBP are at risk of chronic opioid use.[4]

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Most guidelines, such as those from the American College of Physicians (ACP) published in 2011,[5] suggest that, absent certain “red flags” like fever or history of cancer, evaluation of new LBP should be limited to a history and physical exam, and diagnostics such as advanced imaging (computed tomography [CT] and magnetic resonance imaging [MRI]) should not be performed; the American Academy of Family Physicians (AAFP) in 2012 suggested waiting at least 6 weeks before performing such imaging.[6] Treatment modalities for new LBP vary, but guidelines, such as those from the ACP in 2017, suggest that noninvasive treatment of new LBP should begin with nonpharmacologic options such as heat and massage,[7] and some evidence suggests that early use of physical therapy (PT) can forestall the use of opioids.[8] Pharmacologic options include nonsteroidal anti-inflammatory drugs (NSAIDs) and muscle relaxants, with tramadol—a partial mu agonist—as second-line therapy for chronic LBP and opioids as a last resort.[7]

In this study, Medicare data were used to examine recent patterns in the evaluation and treatment of new LBP episodes for elderly adults. Other studies examining trends up to 2010 have found increasing use of opioids and advanced imaging and decreasing use of NSAIDs and acetaminophen.[9,10] However, these studies examined care delivered at randomly sampled individual visits for LBP; because care is delivered longitudinally, this study examined the care delivered to patients for new LBP over the course of a year. This approach allowed the examination of timing of care and sequence of care. In particular, rates in the use of advanced imaging, PT, and pharmacologic therapy for new LBP episodes from the first visit to 365 days later were studied, as well as the distribution in time elapsed from first visit for new LBP to subsequent use of these modalities. This approach also allowed the determination of whether patients who were prescribed opioids had trials of other therapies over the course of the year, while prior studies could only examine whether these therapies were prescribed on the same visit.

Methods

Data Sources and Study Population

Analyses were performed using 2010-2014 claims data for a random 20% sample of Traditional Medicare beneficiaries; data for beneficiaries with Medicare Advantage for the examined time period are not available.[11] International Classification of Diseases, Ninth Revision (ICD-9)[12] codes were used for this study; because of the transition to ICD-10 codes in 2015, this study used data up to 2014 to maintain coding consistency. Beneficiaries aged 66 and over who were continuously enrolled in Medicare Parts A, B, and D the year prior, year of, and year subsequent to their episode of new LBP were included. An episode of new LBP was defined as the first outpatient office evaluation and management visit for LBP, with no visit for LBP and no exposure to opioids in the prior 365 days.[4] For the first visit, only visits where LBP was a top 3 diagnosis were included, although when searching for LBP visits in the prior 365 days and for subsequent visits for new LBP, LBP did not have to be a top 3 diagnosis. Definitions of LBP consistent with prior literature (Appendix Table 1) were used.[13] Patients with “red flags” (which included trauma, neurologic impairment, osteomyelitis, fever, and weight loss) in diagnosis codes in the 30 days prior or 30 days subsequent to the date of the first visit for new LBP were excluded, again using definitions

consistent with prior literature (Appendix Table 2).[13] Patients with a history of cancer or a hospice claim were also excluded.

Outcome Measures

The main evaluative outcome measure was the use of advanced imaging for LBP, defined as a lumbar CT or MRI (Appendix Table 3). This outcome measure included both the use of such imaging in the 365 days subsequent to the date of the first visit for new LBP (a binary outcome) and the distribution of time elapsed from the date of the first visit to use of advanced imaging (conditional on its use).

There were two main treatment outcome measures: the use of PT and the use of medications. PT was defined using Current Procedural Terminology (CPT) codes for PT (Appendix Table 4)[8] along with a diagnosis code for LBP (Appendix Table 1). This outcome measure included both the use of PT in the 365 days subsequent to the date of the first visit for new LBP (a binary outcome) and the distribution of time elapsed to PT use (conditional on its use). The use of medications in the subsequent 365 days was defined using the Part D "event file." The Part D Drug Event File includes beneficiary, prescriber, National Drug Code (NDC), branded name, generic name, strength, quantity dispensed, and days supplied. [14] Medications studied included prescription NSAIDs (Appendix Table 5), muscle relaxants (Appendix Table 6),[10] tramadol, and opioids (Appendix Table 7). Over-the-counter (OTC) medications, such as OTC NSAIDs, are not captured in these data. The distribution of number of days filled of non-opioids and tramadol, number of morphine equivalents filled of opioids, and time elapsed to opioid use (conditional on their use) were studied. Opioids were converted to morphine equivalents using standard conversion tables.[15]

Two additional measures were included. The first was chronic opioid use, defined as 120 days of opioids filled between day 91 and day 365.[16,8] The second was prior benzodiazepine use, as prior benzodiazepine use may influence the medications used for LBP given concerns about prescribing opioids for patients on benzodiazepines.[17] Prior benzodiazepine use was defined as a benzodiazepine (Appendix Table 8) prescription fill within the 2 months prior to the start of the LBP episode.

Covariates

Patient covariates included age, sex, race and ethnicity, and Elixhauser score. The validated Elixhauser method identifies 26 non-cancer, non-red flag patient comorbidities, such as hypertension and diabetes, based on diagnosis codes, and the score is the sum of these comorbidities.[18]

Statistical Analysis

Simple rates of modality use (along with 95% confidence intervals) and percentiles (5^{th} percentile, 25^{th} percentile, median, 75 percentile, and 95^{th} percentile) were reported. Values both for all patients with a visit for new LBP and for the subset of patients with two or more visits for new LBP were reported. Only the first episode of new LBP was kept for patients with more than one episode during the examined time period. All analyses were performed using Stata, version 15.1 (StataCorp, College Station, TX). The Institutional Review Board

of the National Bureau of Economic Research, where the data used are securely housed under a data use agreement with the Centers for Medicare and Medicaid Services, approved the study. The data provided contain only encrypted patient identifiers; cell sizes smaller than 11 are suppressed.[19]

Results

Patient characteristics are reported in Table 1. Out of an initial sample of 799,856 elderly Medicare patients with new LBP, after implementing the restrictions described in the Methods, the sample included 162,238 elderly patients with new LBP between 2011 and 2014. The average age of the patients in the sample was 76.6 years (95% confidence interval [CI] 76.6-76.7). About 70 percent (70.7%; 95% CI 70.5-70.9) were female. White patients composed 78.3% (95% CI 78.1-78.5) of the sample, black patients 6.6% (95% CI 6.5-6.7), Hispanic patients 7.7% (95% CI 7.5-7.8%), Asian/Pacific Islander patients 5.9% (95% CI 5.8-6.0), American Indian/Alaska Native 0.4% (95% CI 0.4-0.5) and those of other race/ethnicity 1.1% (95% CI 1.0-1.1). Under half (45.8%; 95% CI 45.5-46.0) of patients with new LBP had two or more visits. Chronic opioid use developed in 1.08% (95% CI 1.03-1.13) of all patients and in 1.87% (95% CI 1.77-1.96) of patients with two or more visits for new LBP. About 3 percent of all patients previously filled a prescription for a benzodiazepine in the prior 2 months.

About 15 percent (15.5%; 95% CI 15.4-15.7) of all patients and 29.4% (95% CI 29.1-29.8) of patients with two or more visits for new LBP received advanced imaging (Table 2). Of those who received advanced imaging, about half (50.4%; 95% CI 49.8-51.0) of all patients and 48.4% (95% CI 47.7-49.0) of patients with two or more visits for new LBP received advanced imaging within 6 weeks of the first visit. The median time elapsed to receipt of advanced imaging was 45 days for patients with two or more visits, while the 5th percentile was the day after the first visit and the 25th percentile 9 days for patients with two or more visits.

About eleven percent (11.2%; 95% CI 11.0-11.3) of all patients and 17.3% (95% CI 17.1-17.6) of patients with two or more visits for new LBP received PT (Table 3). The median time elapsed to receipt of PT was 33 days for patients with two or more visits, while the 25th percentile was 7 days and the 75th percentile 141 days for patients with two or more visits.

Approximately 35 percent (35.9%; 95% CI 35.7-36.1) of all patients received prescription NSAIDs, 13.5% (95% CI 13.3-13.7) received a muscle relaxant, and 20.4% (95% CI 20.2-20.6) received tramadol, while 42.2% (95% CI 41.8-42.5) of patients with two or more visits received NSAIDs, 16.9% (95% CI 16.6-17.1) of these patients received a muscle relaxant, and 26.2% (95% CI 25.9-26.6) of these patients received tramadol (Table 4). Approximately 40 percent (42.5%; 95% CI 42.3-42.8) of all patients received either an NSAID or a muscle relaxant. About half (52.0%; 95% CI 51.8-52.3) of all patients received an NSAID, a muscle relaxant, or tramadol, and 60.9% (95% CI 60.6-61.3) of patients with two or more visits received at least one of these three medications. The median number of

days received of tramadol for patients with two or more visits was 30, while the 25th percentile was 14 and the 75th percentile 90 for these patients.

Almost a third (32.3%; 95% CI 31.9-32.6) of patients with two or more visits for new LBP received an opioid (Table 5, Panel A). For these patients that received an opioid, the median number of morphine equivalents given in the following year was 400, while the 25th percentile was 175 and the 75th percentile 900 (Table 5, Panel A). For patients with two or more visits who received an opioid, the median time elapsed to receipt of opioids was 83 days, while the 5th percentile was the same day of the first visit and the 25th percentile 6 days (Table 5, Panel B). For these patients, the median number of days supplied was 15 and the median daily dose was 50 morphine equivalents a day (results not shown). For comparison's sake, Center for Disease Control and Prevention recommends "extra precautions" for daily doses of 50 morphine equivalents or greater.[20] Over half (52.4%; 95% CI 51.7-53.0) of patients with two or more visits for new LBP who received an opioid had not received a prescription NSAID, and 82.2% (95%CI 81.7-82.7) of these patients had not received PT (results not shown). About a quarter of all patients (26.1%; 95% CI 25.9-26.3) with new LBP and about a third (34.5%; 95% CI 34.2-34.9) of those with two or more visits had a prescription fill for more than one class of medications examined in this study (prescription NSAIDs, muscle relaxants, tramadol, and opioids) (results not shown).

Discussion

This study of recent evaluation and treatment patterns of new LBP among elderly patients in the United States has several key findings. First, more than half of elderly patients in the United States with new LBP did not have subsequent visits for new LBP in the following year. Second, over a quarter of patients with new and persistent LBP received advanced imaging, and almost half of these patients received imaging sooner than recommended by the AAFP.[6] Third, only a small percentage of patients with new and persistent LBP received PT, and a large percentage of patients who received opioids did not have a trial of PT. Fourth, a third of patients with new and persistent LBP received opioids. Many of these patients received opioids relatively early into the course of their new LBP and over half received opioids without having tried prescription NSAIDs. Fifth, about a quarter of patients with new and persistent LBP were prescribed tramadol, a second-line therapy.

This study is related to Hart and co-authors' 1995 study on physician office visits for LBP and an update by Mafi and colleagues in 2013.[9,10] Compared to those studies, this study focused primarily on episodes of new LBP and it was able to follow patients longitudinally (rather than having a cross section of a randomly selected week of a physician visits). This allowed the assessment of what modalities were tried and not tried and how soon these modalities were used over the course of a year, which may provide a better sense of the care patterns for new LBP.

Other papers, often examining "low-value care," have also studied the use of imaging for LBP.[13] This study focused on advanced imaging, examine episodes of new LBP that result in two or more visits, and it also examined the distribution of time elapsed to receipt of such imaging. Other papers have also examined the use of PT for LBP, but they do so for more

specialized populations[21] or use data from more than a decade ago.[22] And while many studies have examined the opioid-prescribing patterns of physicians,[23-25] no studies that we know of focus on the time elapsed and distribution of that time elapsed to first opioid or on what other modalities were tried before opioids. Few studies examine the use of tramadol, a medication that is being increasingly recognized for its potential for harm.[26]

These results are consistent with the general advice that a large percentage of new LBP episodes are self-limiting.[27] Although prior research has suggested that PT may forestall the use of opioids in LBP,[8,21] it is surprising that a high percentage of patients do not receive PT at all and many patients who eventually receive opioids did not first try PT. Similarly, it is surprising that, when guidelines suggest that opioids should be a last resort for LBP, many patients on opioids have not yet tried prescription NSAIDs, although it is possible that many of these patients instead tried over-the-counter NSAIDs, which are not recorded in these data.

However, pain management, particularly in the elderly population, remains difficult. Opioids in the elderly are associated with an increase risk of fracture and all-cause mortality.[28] NSAIDs have known gastrointestinal, renal, and cardiovascular side effects,[29] while tramadol may cause dizziness and reduce the seizure threshold.[30] Acetaminophen, although it generally has a better safety profile, has been found in a meta-analysis to be ineffective in LBP.[31] Further studies on the comparative efficacy and safety of these medications in the elderly may help guide physicians through the challenging management of LBP.

This study has several limitations. First, results are limited to the Traditional Medicare population and may not generalize to Medicare Advantage beneficiaries (who may have different health and utilization patterns), to younger populations, or to patients who receive their care through the Veterans Health Administration; other studies examine some of these populations but do not have the longitudinal aspect of this study.[9,10] Second, results are based on claims data and details of the history and the physical exam are not included, although this is also a limitation of other claims-based studies. Important missing details include the intensity of the pain and duration of the pain prior to the first outpatient visit. Third, over-the-counter medications are not included in these data, so this study could not examine the use of medications such as over-the-counter acetaminophen and ibuprofen, both of which may be recommended by physicians for new low back; this limitation is shared by other studies. Fourth, this study was not able to examine the use of chiropractic care, osteopathy, or other modalities besides PT that rely on manual manipulation. Fifth, this study's definition of new LBP relies on physicians coding all mentions and discussions of LBP; if LBP was previously discussed but not coded, this study would misidentify more chronic LBP as new LBP.

In conclusion, in a large national sample of elderly adults with Medicare, many patients who develop new LBP receive guideline non-concordant advanced imaging and opioids before other modalities like PT and prescription NSAIDs. Barriers to PT use may include low physician referral rates, patient difficulties (e.g., transportation issues) in obtaining PT even with a referral, and patient preferences. Barriers to use of prescription NSAIDs may include patient co-morbidities precluding their use and patient beliefs of their ineffectiveness after

trialing smaller doses over-the-counter. Other studies, including qualitative studies and surveys, may better delineate barriers to the use of these therapies for LBP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments and conflicts of interest

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References

1. Centers for Disease Control and Prevention. National Ambulatory Medical Care Survey: 2010 Summary Tables. http://www.cdc.gov/nchs/data/ahcd/namcs_summary/2010_namcs_web_tables.pdf. Accessed August 18, 2019.
2. Hoy D, Brooks P, Blyth F, Buchbinder R. The epidemiology of low back pain. Best Pract Res Clin Rheumatol. 2010; 24: 769–81. [PubMed: 21665125]
3. Chou R. In the clinic. Low back pain. Ann Intern Med. 2014; 160: ITC6. [PubMed: 25009837]
4. Moshfegh J, George SZ, Sun E. Risk and risk factors for chronic opioid use among opioid-naïve patients with newly diagnosed musculoskeletal pain in the neck, shoulder, knee, or low back. Ann Intern Med. 2018; 170: 504–5. [PubMed: 30557442]
5. Chou R, Qaseem A, Owens DK, Shekelle P. Clinical guidelines. Diagnostic imaging for low back pain: advice for high-value health care from the American College of Physicians. Ann Intern Med. 2011; 154: 181–88. [PubMed: 21282698]
6. American Academy of Family Physicians. Choosing wisely. Imaging for low back pain. 2012. https://www.aafp.org/patient-care/clinical-recommendations/all/cw-back-pain.html. Accessed August 18, 2019.
7. Qaseem A, Wilt TJ, McLean RM, Forciea MA. Clinical guidelines. Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guidelines from the American College of Physicians. 2017; 166: 514–30.
8. Sun E, Moshfegh J, Rishel CA, Cook CE, Goode AP, George SZ. Association of early physical therapy with long-term opioid use among opioid-naïve patients with musculoskeletal pain. JAMA Network Open. 2018. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2718095. Accessed August 18, 2019.
9. Hart LG, Deyo RA, Cherkin DC. Physician office visits for low back pain. Spine. 1995; 20: 11–19. [PubMed: 7709270]
10. Mafi JN, McCarthy EP, Davis RB, Landon BE. Worsening trends in the management and treatment of back pain. JAMA Intern Med. 2013; 173: 1573–81. [PubMed: 23896698]
11. ResDAC. Medicare Advantage (Part C) Encounter Data RIFs Final Version. 2019. https://www.resdac.org/cms-news/medicare-advantage-part-c-encounter-data-rifs-final-version. Accessed August 18, 2019.
12. Centers for Disease Control and Prevention. ICD-9. 2015. https://www.cdc.gov/nchs/icd/icd9.htm. Accessed August 18, 2019.
13. Schwartz AL, Landon BE, Elshaug AG, Chernew ME, McWilliams JM. Measuring low-value care in Medicare. JAMA Intern Med. 2014; 174: 1067–76. [PubMed: 24819824]
14. ResDAC. Data documentation: Part D drug event file. 2019. https://www.resdac.org/cms-data/files/pde/data-documentation. Accessed August 18, 2019.

15. ResDAC. CMS cell size suppression policy. 2017. https://www.resdac.org/articles/cms-cell-size-suppression-policy. Accessed August 18, 2019.
16. Sun EC, Darnall BD, Baker LC, Mackey S. Incidence of and risk factors for chronic opioid use among opioid-naïve patients in the postoperative period. 2016; 176: 1286–1293.
17. Sun EC, Dixit Am Humphreys K, Darnall BD, Baker LC, Mackey S. Association between concurrent use of prescription opioids and benzodiazpeines and overdose: retrospective analysis. BMJ. 2017; 356: j760. [PubMed: 28292769]
18. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. Med Care 1998;36(1):8–27. [PubMed: 9431328]
19. Center for Medicare and Medicaid Services. Opioid oral morphine equivalent (MME) conversion factors. 2017. https://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovContra/Downloads/Opioid-Morphine-EQ-Conversion-Factors-April-2017.pdf. Accessed August 18, 2019.
20. Center for Disease Control and Prevention. How should the total daily dose of opioids be calculated? 2018. https://www.cdc.gov/drugoverdose/pdf/calculating_total_daily_dose-a.pdf. Accessed August 18, 2019.
21. Childs JD, Fritz JM, Wu SS, Flynn TW, Wainner RS, Robertson EK, et al. Implications of early and guidelines adherent physical therapy for low back pain on utilization and costs. BMC Health Serv Res. 2015: 15. https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-015-0830-3. Accessed August 18, 2019.
22. Gellhorn AC, Chan L, Martin B, Friedly J. Management patterns in acute low back pain: the role of physical therapy. Spine. 2012: 37: 775–82. [PubMed: 21099735]
23. Deyo RA, Smith DHM, Johnson ES, Donovan M, Tillotson CJ, Yang X, et al. Opioids for back pain patients: primary care prescribing patterns and use of services. 2011. J Am Board Fam Med. 2011; 24: 717–27. [PubMed: 22086815]
24. Barnett ML, Olenski AR, Jena AB. Opioid-prescribing patterns of emergency physicians and risk of long-term use. N Eng J Med. 2017; 376: 663–73.
25. Deyo RA, Hallvik SE, Hildebran C, Marino M, Dexter E, Irvine JM. Association between initial opioid prescribing patterns and subsequent long-term use among opioid-naïve patients: a statewide retrospective cohort study. J Gen Intern Med. 2017; 32: 21–27. [PubMed: 27484682]
26. Substance Abuse and Mental Health Services Administration. Emergency department visits for adverse reactions involving the pain medication tramadol. 2015. https://www.samhsa.gov/data/sites/default/files/report_1965/ShortReport-1965.html. Accessed August 18, 2019.
27. Deyo RA, Weinstein JN. Low back pain. N Eng J Med. 2001; 344: 363–70.
28. Solomon DH, Rassen JA, Glynn RJ, Lee J, Levin R, Schneeweiss S. The comparative safety of analgesics in older adults with arthritis. Arch Int Med. 2010; 170: 1968–76. [PubMed: 21149752]
29. Wongrakpanich S, Wongrakpanich A, Melhado K, Rangaswami J. A comprehensive review of non-steroidal anti-inflammatory drug use in the elderly. Aging Dis. 2018; 9:143–50. [PubMed: 29392089]
30. Cavalieri TA. Managing pain in geriatric patients. J Am Osteopath Assoc. 2007; 107: ES10–ES16. [PubMed: 17986672]
31. Machado GC, Maher CG, Ferreira PH, et al. Efficacy and safety of paracetamol for spinal pain and osteoarthritis: systematic review and meta-analysis of randomized placebo controlled trials. 2015; 350: h1225.

Table 1:

Patient Characteristics, 2011-2014

	All episodes of new low back pain (n=162,238)	**Episodes of new low back pain with two or more visits (n=74,234)**
Age (year)	76.6 (76.6-76.7)	76.6 (76.6-76.7)
Female (%)	70.7 (70.5-70.9)	71.6 (71.3-72.0)
Race/ethnicity		
White (%)	78.3 (78.1-78.5)	77.5 (77.2-77.8)
Black (%)	6.6 (6.5-6.7)	6.5 (6.3-6.7)
Hispanic (%)	7.7 (7.5-7.8)	8.0 (7.8-8.2)
Asian/Pacific Islander (%)	5.9 (5.8-6.0)	6.5 (6.3-6.7)
American Indian/Alaska Native (%)	0.4 (0.4-0.5)	0.4 (0.4-0.5)
Other (%)	1.1 (1.0-1.1)	1.1 (1.0-1.2)
Elixhauser score	2.92 (2.91-2.93)	3.08 (3.06-3.09)
Two or more visits for low back pain (%)	45.8 (45.5-46.0)	-
Chronic opioid use (%)	1.08 (1.03-1.13)	1.87 (1.77-1.96)
Prior benzodiazepine use (%)	3.1 (3.0-3.2)	3.3 (3.2-3.5)

Notes: Elixhauser comorbidity software identifies up to 26 non-cancer non-red flag patient comorbidities, such as hypertension and diabetes, based on diagnosis codes found in administrative data, and the score is the sum of these comorbidities. Chronic opioid use was defined as 120 days of opioids filled between day 91 and day 365. Prior benzodiazepine use was defined as a benzodiazepine prescription fill within the 2 months prior to the start of the low back pain episode. Percentages are scaled out of 100. 95% confidence interval in parentheses.

Table 2:

Use of advanced imaging for new low back pain, 2011-2014

	Received advanced imaging	Received advanced imaging in first 6 weeks (of those who received advanced imaging)	Time elapsed to advanced imaging, 5th percentile	Time elapsed to advanced imaging, 25th percentile	Time elapsed to advanced imaging, median	Time elapsed to advanced imaging, 75th percentile	Time elapsed to advanced imaging, 95th percentile
All	15.5 (15.4-15.7)	50.4 (49.8-51.0)	1	8	41	150	316
Two or more visits for low back pain	29.4 (29.1-29.8)	48.4 (47.7-49.0)	1	9	45	154	316

Notes: Advanced imaging is defined as receipt of a lumbar CT or MRI. Time elapsed is defined as the number of days between the first visit for low back pain and receipt of advanced imaging, conditional on its receipt. Percentages are scaled out of 100. 95% confidence interval in parentheses.

Table 3:

Use of physical therapy for new low back pain, 2011-2014

	Received physical therapy	Time elapsed to physical therapy, 5th percentile	Time elapsed to physical therapy, 25th percentile	Time elapsed to physical therapy, median	Time elapsed to physical therapy, 75th percentile	Time elapsed to physical therapy, 95th percentile
All	11.2 (11.0-11.3)	0	5	19	107	300
Two or more visits for low back pain	17.3 (17.1-17.6)	0	7	33	141	310

Notes: Time elapsed is defined as the number of days between the first visit for low back pain and receipt of physical therapy, conditional on its receipt. Percentages are scaled out of 100. 95% confidence interval in parentheses.

Table 4:

Use of non-opioid medications and tramadol for new low back pain, 2011-2014

	Received medication(s)	Days of medication, 5th percentile	Days of medication, 25th percentile	Days of medication, median	Days of medication, 75th percentile	Days of medication, 95th percentile
NSAID						
All	35.9 (35.7-36.1)	10	30	60	180	360
Two or more visits for low back pain	42.2 (41.8-42.5)	10	30	70	200	370
Muscle relaxant						
All	13.5 (13.3-13.7)	6	10	25	40	210
Two or more visits for low back pain	16.9 (16.6-17.1)	7	10	30	50	210
Tramadol						
All	20.4 (20.2-20.6)	5	12	30	90	300
Two or more visits for low back pain	26.2 (25.9-26.6)	5	14	30	90	300
NSAID or muscle relaxant						
All	42.5 (42.3-42.8)	-	-	-	-	-
Two or more visits for low back pain	49.9 (49.5-50.3)	-	-	-	-	-
NSAID, muscle relaxant, or tramadol						
All	52.0 (51.8-52.3)	-	-	-	-	-
Two or more visits for low back pain	60.9 (60.6-61.3)	-	-	-	-	-

Notes: Days of a medication are calculated conditional on receipt of the medication. Percentages are scaled out of 100. 95% confidence interval in parentheses.

Table 5:

Use of opioid medications for new low back pain, 2011-2014

Panel A						
	Received opioid	**Morphine equivalents, 5th percentile**	**Morphine equivalents, 25th percentile**	**Morphine equivalents, median**	**Morphine equivalents, 75th percentile**	**Morphine equivalents, 95th percentile**
All	25.8 (25.6-26.0)	75	150	300	750	3000
Two or more visits for low back pain	32.3 (31.9-32.6)	75	175	400	900	3750
Panel B						
		Time elapsed to opioid, 5th percentile	**Time elapsed to opioid, 25th percentile**	**Time elapsed to opioid, median**	**Time elapsed to opioid, 75th percentile**	**Time elapsed to opioid, 95th percentile**
All		0	4	85	210	331
Two or more visits for low back pain		0	6	83	205	329

Notes: Tramadol, a partial mu agonist, is excluded. Morphine equivalents and time elapsed are calculated conditional on receipt of an opioid. Percentages are scaled out of 100. 95% confidence interval in parentheses.