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A Description and Comparison of Treatments for Low Back Pain in the U.S

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Abstract

Background/Objectives—Low back pain (LBP), a prevalent costly condition, has evidenced-based pharmacologic and non-pharmacologic treatments. Because the prevalence of LBP and opioids use differs between the U.S. Census Regions, we compared the treatments used for LBP and their related costs between regions.

Methods—De-identified patient health claims data from persons with LBP along with treatments received was extracted from a large commercially insured dataset (2007-2009; $N=1,630,438$). Descriptive statistics and ANOVA analyses were used during data analysis.

Results—An opioid was used by 49.8% ($n=812,479$) of this sample while nonpharmacologic therapies were rarely used (8%-psychological therapies; 19%-exercise therapies; 12%-PT). The median costs for pharmacologic and non-pharmacologic treatments are variable. We found significant differences in the medications and therapies used in the U.S. Census Regions ($p<.0001$).

Conclusion—Overuse of pharmacologic and underuse of non-pharmacologic treatments is common among persons with LBP. Differences exist in the receipt of various LBP treatments geographically.

Keywords

low back pain; standardized costs; recommended treatments

Introduction

Impact and Prevalence of Low Back Pain

An estimated 67% to 84% of persons residing in industrialized countries experience low back pain (LBP). This prevalence is variable in geographic locations throughout the U.S.

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(U.S. Census Regions; Figure 1a) (Centers for Disease Control and Prevention, 2013; Fourney et al., 2011). Low back pain (LBP) is a significant source of lost productivity, disability claims, and increased health care costs (Centers for Disease Control and Prevention, 2013; Chou et al., 2007; Dagenais, Caro, & Haldeman, 2008; Fourney et al., 2011; Luo, Pietrobon, Sun, Liu, & Hey, 2004). An estimated 2% of the U.S. workforce is compensated for work days lost to back injuries, and LBP is responsible for more lost workdays and disability claims than any other health condition (Chou et al., 2007; Fourney et al., 2011). The most current published data (1998) estimates the direct, treatment costs of LBP to be 90 billion U.S. dollars (Dagenais et al., 2008; Luo et al., 2004).

Treatments for Low Back Pain

In efforts to prevent disability, in 2007 the American College of Physicians (ACP) and the American Pain Society (APS) developed clinical practice guidelines for the diagnosis and management of acute and chronic LBP (Chou et al., 2007). Three of the seven guidelines address treatment and include: 1) providing patient education about the course of the condition and self-care, 2) the use of medications with proven efficacy, and 3) the use of non-pharmacologic therapies with proven efficacy (Chou et al., 2007). There were only three treatments with “good” evidence (defined as: *results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes*) to support a moderate effect in the treatment of acute LBP (Defined as: *10 to 20 point improvement on a 100-point scale for pain and functional status*). These three treatments include: 1) the use of non-steroidal anti-inflammatory drugs (NSAIDs), 2) the use of skeletal muscle relaxants, and 3) the application of superficial heat (Chou et al., 2007). For chronic LBP the six therapies that had “good” evidence to produce a “moderate” effect were: the use of NSAIDs, exercise therapy, cognitive behavioral therapy, interdisciplinary rehabilitation, spinal manipulation, and tricyclic anti-depressants (Chou et al., 2007). Interestingly, there was only “fair” evidence (Defined as: *sufficient but the strength of the evidence is limited*) to support the moderate effect of opioids, tramadol, and benzodiazepines (Chou et al., 2007). Although authors of the ACP and APS guidelines include the use of medications classified as opioids and benzodiazepines as a potential LBP treatment option, they also state that the potential harms of therapy (i.e., potential addiction and overdose) should be considered prior to initiating therapy.

All Cause Opioid Use Across the U.S

Because of the varying prevalence of LBP in U.S. Census Regions and the described use of opioids for LBP treatment, it is interesting that opioid use also varies in different regions and states within the U.S. (Centers for Disease Control and Prevention, 2013; McDonald, Carlson, & Izrael, 2012). For example, in 2008, the top five states (Nevada, Delaware, Florida, Kentucky and Tennessee) for milligrams of opioids dispensed per resident, had a 155% to 210% increase above the mean (McDonald et al., 2012). There is a significant difference in the total mean milligrams of opioids dispensed per resident in the states included in the various U.S. Census Regions ($p = .0014$; Northeast = 3,829, Midwest = 5,229, West = 7,092, South = 11,724; Figure 1b) (McDonald et al., 2012).

Adherence with Recommended LBP Guidelines and Related Clinical Importance

Despite LBP treatment recommendations and cautions, there is research suggesting that the use of evidenced-based LBP treatments is variable. Ivanova and colleagues extracted data from a large private insurance database from 2004 to 2006 and found that 42% of persons with LBP filled a prescription for an opioid pain medication and 12% filled a prescription for a benzodiazepine; yet only 23% received exercise therapy and 8% received cognitive behavioral therapy (Ivanova et al., 2011) suggesting that pharmacologic therapies are often over utilized and nonpharmacologic therapies under utilized. Because there is evidence from the nursing literature suggesting that 40% of patients with acute LBP have functional limitations at 3 months, it is critically important that we identify areas where LBP can be improved (Howard & Shapiro, 2013). This data is important for orthopaedic nurses to improve patients' health outcomes. Important first steps are confirming prior research suggesting that evidence-based therapies are not being practiced and then determining the barriers to receipt of these evidenced-based therapies (Ivanova et al., 2011).

Purpose

Because prior research suggests that there is wide variation in the use of evidenced-based LBP treatments, and that opioid medication use and the prevalence of LBP differs between U.S. Census Regions, we aimed to provide further depth to the understanding about utilization of LBP treatment recommendations in the various U.S. geographic regions by describing and comparing the therapies used and their related costs (Centers for Disease Control and Prevention, 2013; Ivanova et al., 2011; McDonald et al., 2012).

Materials and Methods

Our research team licensed deidentified patient health claims information from a large commercially insured population for the period January 1, 2007 to December 31, 2009. The dataset is a nationally representative sample of 15 million patients annually across the U.S. Data are collected at the patient level and linked across administrative and health data including: administrative data (i.e., gender, age), pharmacy claims data (i.e., national drug code, pricing), physician and facility claims (i.e., procedure codes, diagnosis codes, pricing), and lab results (i.e., logical observation identifiers names and codes, lab test name).

Data from persons with the diagnosis of LBP or related terms (ICD-9 code: 724.2 [lumbago], 724.5 [backache], 724.9 [disorder of pain NOS], 847.2 [lumbar region sprain/strain], 846.0 [lumbosacral sprain/strain], 724.79 [symptom back NEC], 724 [disorder back other unspecified]) was extracted along with linked treatments including: physical therapy services, occupational therapy, self-care training, exercise therapy, traction, biofeedback, psychological therapies, surgical procedures, and medications (Tables 1-3: CPT codes extracted). Each person is represented one time in data analyses. Because it appeared that some medications were erroneously linked to the diagnosis of LBP, only those medications that are used for the treatment of LBP are reported. For example, statins, oral contraceptives, and anti-hypertensive medications were not included in this analysis. Although the ACP/APS clinical practice guidelines for the diagnosis and management of acute and chronic LBP (Chou et al., 2007) do not describe the use of anticonvulsants or hypnotics,

these medications could plausibly be used for the indication of LBP and therefore, are included in our analysis.. The demographic data (i.e, age, income, education, race/ethnicity) for these individuals were also extracted. The University of Kentucky Institutional Review Board approved this study.

Statistical analyses

We used descriptive statistics to describe the sample and the frequency of the treatments received for LBP. We used ANOVA to compare the different U.S. Census Regions. A level of significance of .05 was used during analyses. SAS version 9.3 (SAS Institute, Inc., Cary, NC) was used during statistical analyses.

Results

Demographics—The predominance of our sample ($N = 1,630,438$ persons with LBP [or a related term] claim) resided in the Midwest and South U.S. Census Regions. Similarly, 73% of persons were Caucasian and 58% were female. There was an equitable distribution of levels of income and education within this sample (Table 4).

Treatments Used—A prescription for an opioid or analgesic medication (specifically-tramadol) was filled by nearly half of the sample (analgesic: $n = 166,958$ [10.2%]; opioid: $n = 812,479$ [49%]) and 24% ($n = 394,212$) of this sample filled a prescription for a muscle relaxant. Similarly, 39% ($n = 642,243$) filled a prescriptions for a NSAID. The use of other medications to treat LBP (i.e., hypnotics, steroids, sedatives, and anticonvulsants) is described in Figure 2.

We evaluated the median standardized cost of medications used to treat LBP per drug class along with the interquartile range (IQR [25th-75th percentile]; Figure 3). Although the fewest number of persons obtained a prescription for anti-convulsants ($n = 49,073$), the standardized cost was the highest (\$452; IQR = \$185.15-1,536). In contrast, opioids were the most frequently used ($n = 812,479$) with the lowest standardized cost (\$16; IQR = \$7.72-42.66) (Figure 3).

Nonpharmacologic therapies such as exercise therapy and cognitive behavioral therapy were rarely used by persons in this sample (psychological therapies: $n = 128,507$ [8%]; exercise therapies $n = 308,677$ [19%]). Only 12% of persons in this sample received a physical therapy evaluation (Figure 4).

The median costs and associated interquartile ranges for non-pharmacologic treatments are variable with surgical procedures being exponentially more costly (\$5,526; IQR = \$1,312-15,670 - surgical procedures vs. \$40; IQR \$23-100 - hot and cold packs; Figure 5).

Differences between the U.S. Census Regions

There was a significant difference in the medications and therapies used in the four U.S. Census Regions. Interestingly, self-care training is a first-line treatment recommendation; yet, only 1.4% to 2.2% of persons received this treatment. Persons residing in the Northeast and Midwest were more likely to receive psychological therapies. Similarly, persons residing in the Midwest (18.2%), Northeast (24.3%), and West (25.5%) were more likely to receive exercise therapy than those in the South (16%) (Figure 5). Persons in the South were more likely to fill a prescription for opioids (South 53.2%, Midwest 48.6%, West 47%, Northeast 41.8%) and benzodiazepines (South 16.5%, Northeast 14.5%, West 13.7%, Midwest 12.7%) (Figure 1c -1e).

Discussion

Findings from this study support prior research reporting the frequency in which many LBP treatments are utilized (Ivanova et al., 2011). Prior research found that 42% of persons with LBP filled a prescription for an opioid pain medication and in our study we found that 49% filled a prescription for an opioid. Because the South U.S. Census Region has an increased prevalence of LBP and increased opioid use, the slight differences found between these studies may be due to the over-representation of the South in our sample (Centers for Disease Control and Prevention, 2013; McDonald et al., 2012). Approximately 15% of our sample filled a prescription for a benzodiazepine compared with prior studies reporting that 12% of their sample filled a prescription for this drug class; thus, a negligible difference (Ivanova et al., 2011). In our study only 19% of persons received exercise therapy compared with prior studies reporting 23% of their sample received this therapy. Prior research reports that same percentage of persons received psychological therapies for LBP (8%) suggesting that the use of this resource is persistently poor (Ivanova et al., 2011). Considering the prevalence of LBP and availability of cognitive therapies, it is possible this is a problem with access to care.

Opioids were the most commonly prescribed medication class for LBP in this study ($n = 812,479$), and they were the least costly (median cost per person = \$16.23); in contrast, only 49,073 persons filled a prescription for an anticonvulsant and the cost was \$451.93 (Figure 3). The range of the cost of medications per class was also variable. Similar variability was found in the non-pharmacologic treatments for LBP. Although only 2,685 persons received surgery for LBP the median cost per person was \$5,526 and the interquartile range was \$1,312 to \$15,670. Approximately 308,677 persons received exercise therapy and the cost was \$350 per person with a range of \$120 to \$880 (Figure 5). Although direct costs of treatment have been reported, we could not identify studies that have conducted similar analyses for comparison.

Prior research has suggested that LBP is more prevalent and opioid use is increased in the South U.S. Census Region (Centers for Disease Control and Prevention, 2013; McDonald et al., 2012). Findings from this study support that opioid use for the diagnosis of LBP is significantly increased the South region; yet many non-pharmacologic therapies such as psychological therapies are used less frequently. Future studies should aim to determine if non-pharmacologic treatments for LBP are not ordered by health care providers or if patients

choose not to pursue therapies despite provider recommendations. Identifying and developing interventions aimed at decreasing barriers to patients receiving evidenced-based therapies for LBP should be addressed in future research. It seems plausible that providers do not recommend therapies because of lack of availability to their patient population or that provider orders are written but, because of lack of access or costs, patients do not receive the therapies. By clarifying barriers to evidenced-based LBP treatment such as these, problem-directed interventions can be developed.

Data from this study was obtained from a high-quality, large private insurance database; yet it is a retrospective study and therefore, we were limited by the data available. With this being said, it is possible that persons with the diagnosis of LBP were later found to have a more specific etiology for their LBP (i.e., spinal stenosis). There could also be inaccuracies in the linkages between diagnosis and treatment codes (i.e., medications were erroneously linked to LBP diagnosis). The possibility exists that persons represented in a private insurance dataset systematically receive different treatments than persons who use governmental health insurance or pay for healthcare out-of-pocket. It is also possible that additional treatments that did not incur an insurance cost were received by persons in our sample. For example, persons in the sample may have received educational counseling by their provider and this service was not billed with a CPT code. The medications cost may be a representation of those medications preferred by insurance plans. An additional limitation of this study is that each U.S. Census Region was not equally represented.

Clinical Nursing Implications—Our study findings suggest that many evidenced-based treatments for LBP are not received by patients and that significant differences exist in the receipt of therapies in geographic regions in the U.S. These findings identify an area for improvement in the care provided to patients with LBP and because an estimated 40% of acute LBP patients experience long-term disability, it is imperative that barriers to patient receipt of evidenced-based care are identified and interventions developed (Howard & Shapiro, 2013). Nurses play a critical role in facilitating access to treatments for persons with variable resources; thus, study findings are important first steps towards improvement in the patient care provided by nurses caring for patients with LBP.

Conclusion

From this study along with prior research, we can conclude that the utilization of treatments for LBP is widely variable (Ivanova et al., 2011). Opioid medications are used by nearly half of this large sample while only 19% of the sample received exercise therapy. We also found that there are significant differences in the receipt of various LBP treatments per U.S. Census Region. These findings along with future research can provide clarity the geographic barriers that exist to patients receiving evidence-based LBP treatments.

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Figure 1.

a. Prevalence of LBP

b. Total mean milligrams of opioids dispensed per resident.

c. Comparisons of medication usage (in percentages) by regions among adult patients with low back pain (N= 1,630,438)

Frequency of Adults with Low Back Pain by US Census Bureau Regions

*Comparison significant at the $p < .0001$ level

d. Comparisons of therapy usage (in percentages) by regions among adult patients with low back pain ($N = 1,630,438$)

*Comparison significant at the $p < .0001$ level

e. Comparisons of therapy usage (in percentages) by regions *among adult patients with low back pain* ($N = 1,630,438$)

†Comparison significant at the $p = .01$ level

*Comparison significant at the $p < .0001$ level

Figure 2. Frequency of drug use per class

Figure 3. Median cost per medication class

Figure 4. Frequency of use of non-pharmacologic treatments for LBP

Figure 5. Median cost per non-pharmacologic treatment

Table 1
CPT Codes for spinal surgical procedures

CPT Code	Description
20930-31	Allograft for spine surgery only, morselized; structural
20936-38	Autograft for spine surgery only, local; morselized; structural
225-48;58;85	Arthrodesis- anterior transoral or extraoral technique; anterior interbody technique, including minimal discectomy, lumbar; anterior approach, lumbar, each additional interspace
226-12,14,30,32	Arthrodesis- posterior or posterolateral technique, lumbar; posterior or posterolateral technique, each additional vertebral segment; posterior interbody technique, lumbar; posterior interbody technique, each additional interspace
22830	Exploration of spinal fusion
22840	Posterior non-segmental instrumentation
22841	Internal spinal fixation by wiring of spinous processes
22842-44	Posterior segmental instrumentation- 3-6 vertebral segments; 7-12 vertebral segments; 13+ vertebral segments
22845-47	Anterior instrumentation, 2-3 vertebral segments; 4-7 vertebral segments; 8+ vertebral segments
22849	Reinsertion of spinal fixation device
22850	Removal of posterior nonsegmental instrumentation
22851	Application of intervertebral biomechanical device
22852;55	Removal of posterior segmental instrumentation; anterior instrumentation
63005;011	Laminectomy with exploration and/or decompression, 1-2 vertebral segments, lumbar; sacral
63012	Laminectomy with removal of abnormal facets with decompression, lumbar
63017	Laminectomy with exploration and/or decompression, >2 vertebral segments, lumbar
63030;35	Laminotomy (hemilaminectomy) with decompression, 1 interspace, lumbar; each additional interspace, cervical or lumbar
63042;44	Laminotomy (hemilaminectomy) with decompression, reexploration, 1 interspace, lumbar; each additional lumbar interspace
63047,48	Laminectomy, facetectomy, and foraminotomy with decompression, 1 vertebral segment, lumbar; each additional vertebral segment
63056,57	Transpedicular approach with decompression, 1 segment, lumbar; each additional segment, lumbar
63170	Laminectomy with myelotomy, cervical, thoracic, or thoracolumbar
63185,90	Laminectomy with rhizotomy, 1-2 segments; more than 2 segments
63200	Laminectomy, with release of tethered spinal cord, lumbar
63267,68	Laminectomy with excision or evacuation of intraspinal lesion other than neoplasm, lumbar; sacral
63272,73	Laminectomy for excision of intraspinal lesion other than neoplasm, lumbar; sacral
22224,26	Osteotomy of spine, including discectomy, lumbar; each additional segment
62287	Aspiration or decompression procedure, percutaneous, of nucleus pulposus of intervertebral disc (e.g., percutaneous discectomy, percutaneous laser discectomy)
69990	Microsurgical techniques, requiring use of operating microscope

Table 2
CPT codes for physical therapy services

CPT Code	Description
97001	physical therapy evaluation
97002	physical therapy re-evaluation
97140	manual therapy
97530	therapeutic activities
97112	neuromuscular re-education
97113	aquatic therapy
97116	gait training
97010	hot/cold packs
97035	iontophoresis
97012	traction

Table 3
CPT codes of other low back pain treatment

CPT Code	Description
97003	Occupation therapy evaluation
97004	Occupational therapy re-evaluation
97124	Massage
97535	Self-care training
97110	Exercise therapy
90801, 90802, 90816, 90818, 90821, 90853, 96150, 96151, 96152, 96153, 97770	Psychological therapies
90901, 90875, 90876	Biofeedback

Table 4Demographic characteristics ($N = 1,630,438$).

Variable	Sample n (%)	2013 General U.S. Population
Gender		
Male	692,253 (42.5%)	49.2%
Female	938,105 (57.5%)	50.8%
Race/Ethnicity		
Caucasian	1,183,171 (72.6%)	77.7%
African American	105,156 (6.5%)	13.2%
Hispanic	151,209 (9.3%)	17.1% (62.6% White alone, not Hispanic or Latio)
Other	190,902 (11.7%)	8.9%
Education		
Less than 12 th Grade	31,224 (1.9%)	
High School Diploma	601,395 (36.9%)	88% (2012)
Some college	606,102 (37.2%)	
Associate Degree	112,380 (6.9%)	
Bachelor Degree	221,964 (13.6%)	
Master/Professional/Doctoral Degree	2,383 (0.14%)	
Uncoded	35,366(2.2%)	
Income		
		Median household income 2009-2013: \$53,046
< \$30,000	99,479(6.1%)	29.7%
\$30,000-\$49,999	350,377 (21.5%)	18.9%
\$50,000-\$74,999	412,641 (25.3%)	20.3% (\$50,000-\$79,999)
\$75,000-\$99,999	263,268 (16.2%)	8.9% (\$80,000-\$99,999)
\$100,000-\$149,999	213,303(13.1%)	12.4% (\$100,000-\$149,999)
\$150,000-\$250,000	38,581 (2.4%)	9.4% (>\$150,000)
Uncoded	233,165(14.3%)	

(National Information Center for Higher Education Policymaking and Analysis, 2013; U.S. Census Bureau, 2013)