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A Description and Comparison of Treatments for Low Back Pain in the United States

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BACKGROUND/OBJECTIVES: Low back pain (LBP), a prevalent costly condition, has evidence-based pharmacological and nonpharmacological treatments. Because the prevalence of LBP and the use of opioids differ between the U.S. Census Regions, we compared the treatments used for LBP and their related costs between regions.

METHODS: Deidentified patient health claims data from persons with LBP along with treatments received were extracted from a large commercially insured data set (2007–2009; $N = 1{,}630{,}438$). Descriptive statistics and analyses of variance were used during data analysis.

RESULTS: An opioid was used by 49.8% ($n = 812{,}479$) of this sample, whereas nonpharmacological therapies were used less frequently (8%, psychological therapies; 19%, exercise therapies; 12%, physical therapy). The median costs for pharmacological and nonpharmacological treatments are variable. We found significant differences in the medications and therapies used in the U.S. Census Regions ($p < .0001$).

CONCLUSION: Overuse of pharmacological treatment and underuse of nonpharmacological treatment are common among persons with LBP. Differences exist in the receipt of various LBP treatments geographically.

Introduction

Impact and Prevalence of Low Back Pain

An estimated 67%–84% of persons residing in industrialized countries experience low back pain (LBP). This prevalence is variable in geographic locations throughout the United States (U.S. Census Regions [Figure 1 A]; Centers for Disease Control and Prevention, 2013; Fourney et al., 2011). Low back pain is a significant source of lost productivity, disability claims, and increased healthcare 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 workdays 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) estimate the direct treatment costs of LBP to be U.S. $90 billion (Dagenais et al., 2008; Luo et al., 2004).

Treatments of LBP

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 nonpharmacological 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 nonsteroidal 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

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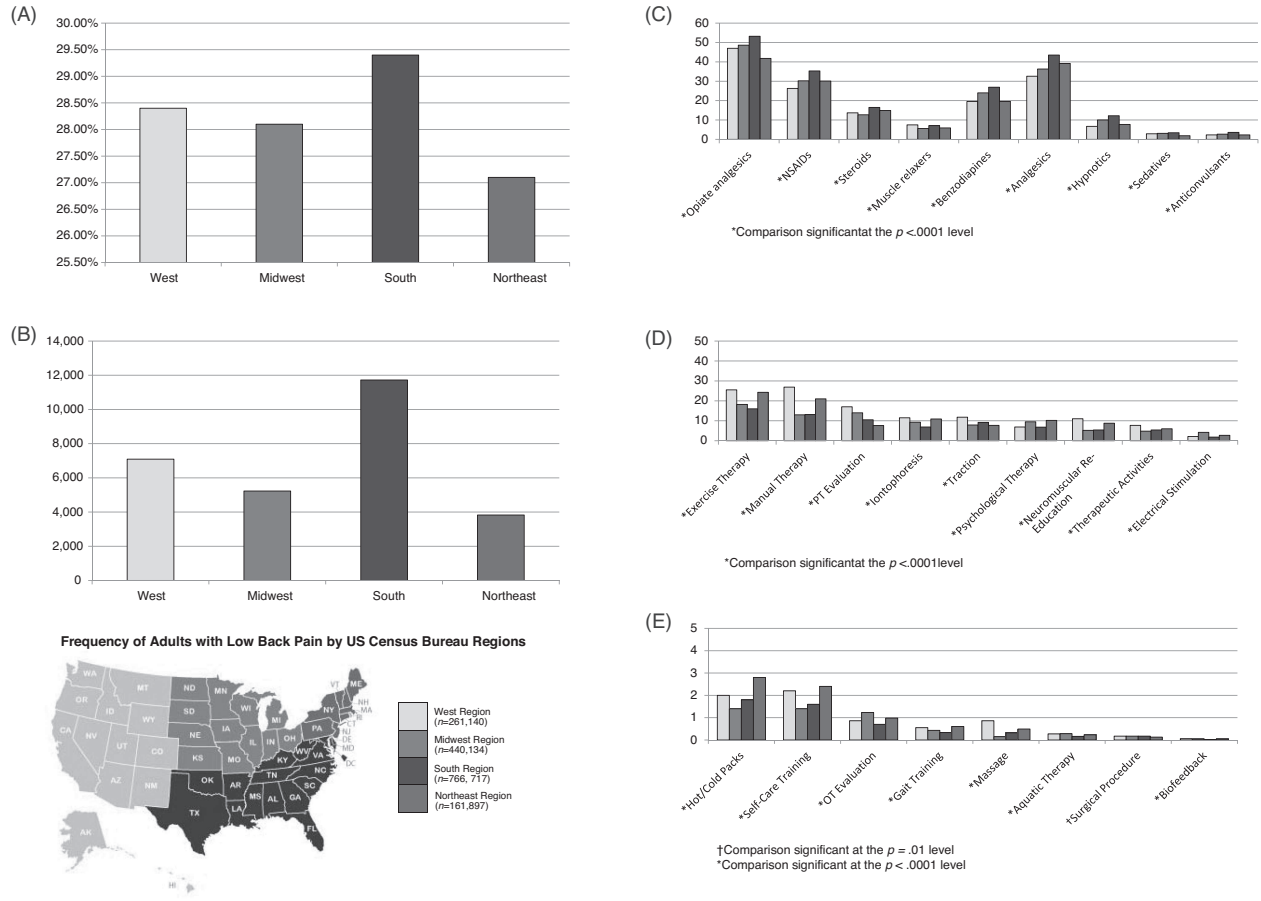

FIGURE 1. (A) Prevalence of LBP. (B) Total mean milligrams of opioids dispensed per resident. (C) Comparisons of medication usage (in percentages) by regions among adult patients with LBP (N = 1,630,438). (D) Comparisons of therapy usage (in ßpercentages) by regions among adult patients with LBP (N = 1,630,438). (E) Comparisons of therapy usage (in percentages) by regions among adult patients with LBP (N = 1,630,438). LBP = low back pain; NSAID = nonsteroidal anti-inflammatory drug; PT = physical therapy.

behavioral therapy, interdisciplinary rehabilitation, spinal manipulation, and tricyclic antidepressants (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/APS clinical practice 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 before initiating therapy.

All-Cause Opioid Use Across the United States

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 United States (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%–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; see 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 evidence-based LBP treatments is variable. Ivanova et al. (2011) 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, suggesting that pharmacological therapies are often overutilized and nonpharmacological therapies underutilized. 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 areas

where LBP can be improved are identified (Howard & Shapiro, 2013). These data are 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 evidence-based therapies (Ivanova et al., 2011).

Purpose

Because prior research suggests that there is wide variation in the use of evidence-based LBP treatments and that opioid medication use and the prevalence of LBP differs between U.S. Census Regions, the authors 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 analyzed deidentified patient health claims information from a large commercially insured population for the period January 1, 2007 to December 31, 2009. The data set is a nationally representative sample of 15 million patients annually (30 million patients for 2 years) across the United States. 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 laboratory results (i.e., logical observation identifiers names and codes, laboratory test name).

Data from persons with the diagnosis of LBP or related terms (*International Classification of Diseases, Ninth Revision*, 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], and 724 [disorder back other unspecified]) were extracted along with linked treatments including physical therapy services, occupational therapy, self-care training, exercise therapy, traction, biofeedback, psychological therapies, surgical procedures, and medications (see Tables 1–3: *Current Procedural Terminology* [*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 antihypertensive 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

The authors used descriptive statistics to describe the sample and the frequency of treatments received for LBP. We used analysis of variance 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 (see 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 prescription for an 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; see Figure 3). Although the fewest number of persons obtained a prescription for anticonvulsants (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; see Figure 3).

Nonpharmacological therapies such as exercise therapy and cognitive-behavioral therapy were infrequently 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 (see Figure 4).

The median costs and associated IQRs for nonpharmacological treatments are variable, with surgical procedures being exponentially more costly (surgical procedures: $5,526, IQR = $1,312–$15,670 vs. hot and cold packs: $40, IQR = $23–$100; see 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%–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%) (see Figure 5). Persons in the South were more likely to fill a prescription for opioids (South:

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 nonsegmental instrumentation
22841	Internal spinal fixation by wiring of spinous processes
22842-44	Posterior segmental instrumentation—three to six vertebral segments; seven to 12 vertebral segments; 13+ vertebral segments
22845-47	Anterior instrumentation—two to three vertebral segments; four to seven vertebral segments; eight+ 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, one to two vertebral segments, lumbar; sacral
63012	Laminectomy with removal of abnormal facets with decompression, lumbar
63017	Laminectomy with exploration and/or decompression, more than two vertebral segments, lumbar
63030;35	Laminotomy (hemilaminectomy) with decompression, one interspace, lumbar; each additional interspace, cervical or lumbar
63042;44	Laminotomy (hemilaminectomy) with decompression, reexploration, one interspace, lumbar; each additional lumbar interspace
63047,48	Laminectomy, facetectomy, and foraminotomy with decompression, one vertebral segment, lumbar; each additional vertebral segment
63056,57	Transpedicular approach with decompression, one segment, lumbar; each additional segment, lumbar
63170	Laminectomy with myelotomy, cervical, thoracic, or thoracolumbar
63185,90	Laminectomy with rhizotomy, one to two segments; more than two 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

Note. CPT = Current Procedural Terminology.

Table 2. *CPT* Codes for Physical Therapy Services

CPT Code	Description
97001	Physical therapy evaluation
97002	Physical therapy reevaluation
97140	Manual therapy
97530	Therapeutic activities
97112	Neuromuscular reeducation
97113	Aquatic therapy
97116	Gait training
97010	Hot/cold packs
97035	Iontophoresis
97012	Traction

Note. CPT = Current Procedural Terminology.

Table 3. *CPT* Codes of Other Low Back Pain Treatment

CPT Code	Description
97003	Occupation therapy evaluation
97004	Occupational therapy reevaluation
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

Note. CPT = Current Procedural Terminology.

Table 4. Demographic 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 Latino)
Other	190,902 (11.7%)	8.9%
Education		
Less than 12th grade	31,224 (1.9%)	
High school diploma	601,395 (36.9%)	88% (for 2012)
Some college	606,102 (37.2%)	
Associate degree	112,380 (6.9%)	
Bachelor's degree	221,964 (13.6%)	
Master's/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%)	

Note. Data from National Information Center for Higher Education Policymaking and Analysis (2012); U.S. Census Bureau (2013a, 2013b).

53.2%; Midwest: 48.6%; West: 47%; Northeast: 41.8%) and benzodiazepines (South: 16.5%; Northeast: 14.5%; West: 13.7%; Midwest: 12.7%) (see Figures 1C–1E).

Discussion

Findings from this study support prior research reporting the frequency with 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 overrepresentation of the South in our sample

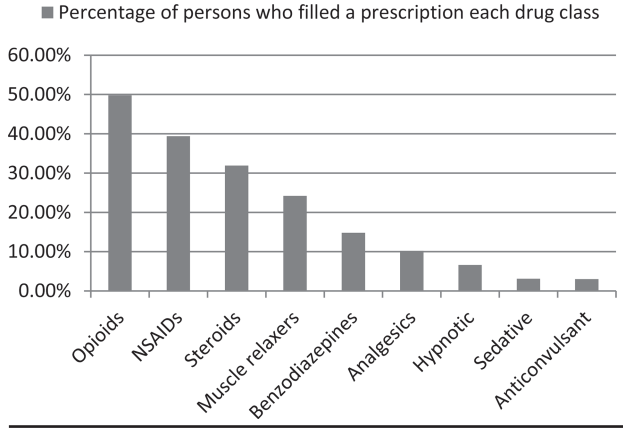

Figure 2. Frequency of drug use per class. NSAID = nonsteroidal anti-inflammatory drug.

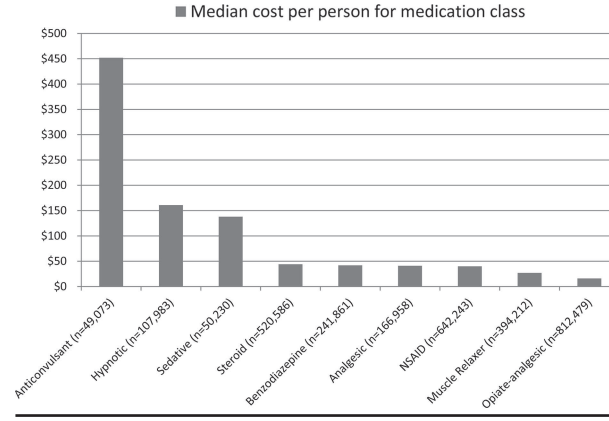

Figure 3. Median cost per medication class. NSAID = nonsteroidal anti-inflammatory drug.

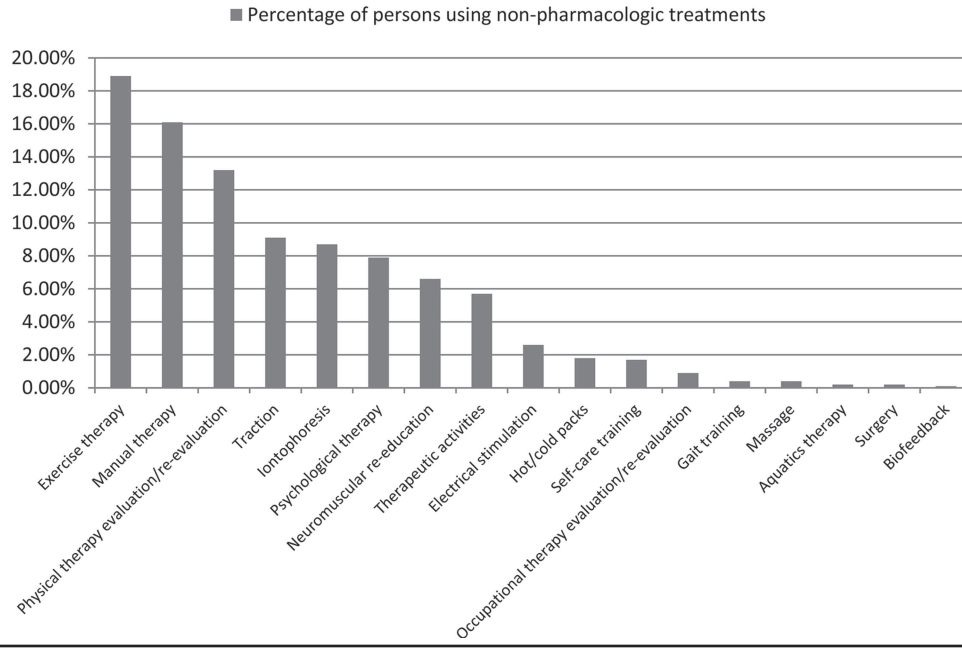

FIGURE 4. Frequency of use of nonpharmacological treatments of low back pain.

(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 that 23% of their sample received this therapy. Prior research reports that the 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 (see Figure 3). The range of costs of medications per class was also variable. Similar variability was found in the nonpharmacological treatments of LBP. Although only 2,685 persons received surgery for LBP, the median cost per person was $5,526 and the IQR was $1,312–$15,670. Approximately 308,677 persons received exercise therapy and the cost was $350 per person, with a range of $120–$880 (see Figure 5). Although direct costs of treatment have been reported, we could not identify studies that have conducted similar analyses for comparison.

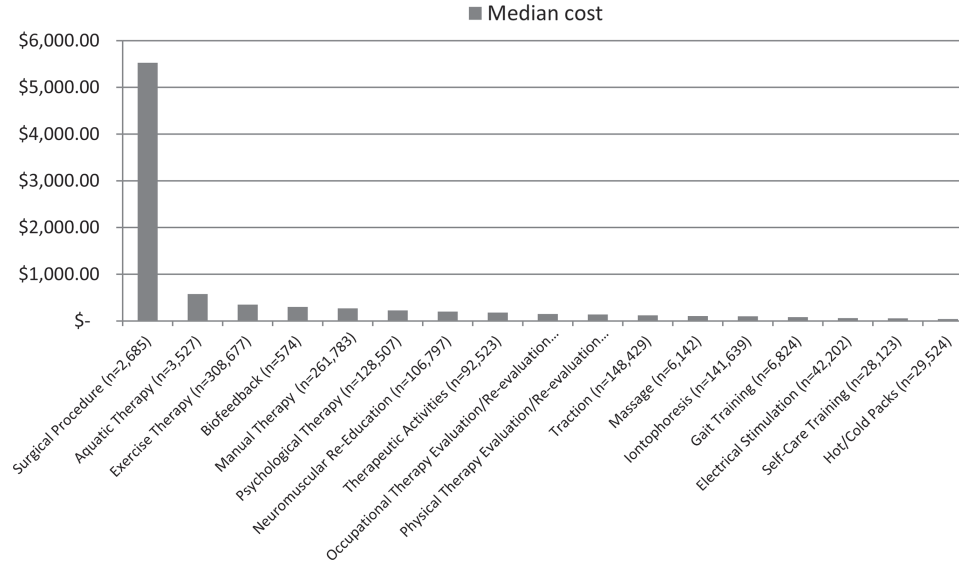

FIGURE 5. Median cost per nonpharmacological treatment of low back pain.

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 in the South region; yet, many nonpharmacological therapies such as psychological therapies are used less frequently. Future studies should aim to determine whether nonpharmacological treatments of LBP are not ordered by healthcare providers or whether patients choose not to pursue therapies despite provider recommendations. Identifying and developing interventions aimed at decreasing barriers to patients receiving evidence-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 evidence-based LBP treatment such as these, problem-directed interventions can be developed.

Data from this study were 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 a 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 data set 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 evidence-based treatments of LBP are not received by patients and that significant differences exist in the receipt of therapies in geographic regions in the United States. These findings identify an area for improvement in the care provided to patients with LBP and because an estimated 40% of patients with acute LBP experience long-term disability, it is imperative that barriers to patient receipt of evidence-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 toward 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 of LBP is widely variable (Ivanova et al., 2011). Opioid medications are used by nearly half of this large sample, whereas 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 on the geographic barriers that exist to patients receiving evidence-based LBP treatments.

Acknowledgments

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