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Primary care referral of patients with low back pain to physical therapy: impact on future healthcare utilization and costs

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STUDY DESIGN:

Retrospective cohort

OBJECTIVE:

To describe physical therapy utilization following primary care consultation for low back pain (LBP) and evaluate associations between the timing and content of physical therapy and subsequent healthcare utilization and costs.

SUMMARY OF BACKGROUND DATA:

Primary care management of LBP is highly variable and the implications for subsequent costs are not well-understood. The value of referring patients from primary care to physical therapy has been debated, and information on how the timing and content of physical therapy impact subsequent costs and utilization is needed.

METHODS:

Data were extracted from a national database of employer-sponsored health plans. 32,070 patients with a new primary care LBP consultation were identified and categorized based on the use of physical therapy within 90 days. Patients utilizing physical therapy were further categorized based on timing (early (within 14 days) or delayed) and content (guideline adherent or non-adherent). LBP-related healthcare costs and utilization in the 18-months following primary care consultation were examined.

RESULTS:

Physical therapy utilization was 7.0% with significant geographic variability. Early physical therapy timing was associated with decreased risk of advanced imaging (OR = 0.34, 95% CI: 0.29, 0.41), additional physician visits (OR = 0.26, 95% CI: 0.21, 0.32), surgery (OR = 0.45, 95% CI: 0.32, 0.64), injections (OR = 0.42, 95% CI: 0.32, 0.64), and opioid medications (OR = 0.78, 95% CI: 0.66, 0.93) as compared with delayed physical therapy. Total medical costs for LBP were $2736.23 lower (95% CI: 1810.67, 3661.78) for patients receiving early physical therapy. Physical therapy content showed weaker associations with subsequent care.

CONCLUSION:

Early physical therapy following a new primary care consultation was associated with reduced risk of subsequent healthcare compared with delayed physical therapy. Further research is needed to clarify exactly which patients with LBP should be referred to physical therapy; however if referral is to be made, delaying the initiation of physical therapy may increase risk for additional healthcare consumption and costs.

KEYWORDS: primary care, physical therapy, health services research

MINI ABSTRACT

This study evaluated utilization of physical therapy following a new primary low back pain care consultation. Overall, 7% of patients received physical therapy within 90 days

with significant geographic variation. Early physical therapy was associated with reduced risks of healthcare utilization and reduced costs over an 18-month follow-up compared to delayed utilization.

KEY POINTS

- This study examined the utilization of physical therapy within 90 days of a new primary care consultation for low back pain and associations with subsequent healthcare utilization and costs using a national database of employee-based healthcare insurance plans.
- Utilization of physical therapy occurred in 7.0% of patients with significant geographic variation.
- Compared with the entire sample of patients, healthcare costs were higher for patients utilizing physical therapy
- Among patients utilizing physical therapy, early referral (within 14 days of the primary care consultation) was associated with reduced risk of subsequent healthcare utilization including advanced imaging, additional physician visits, major surgery, lumbar spine injections, and opioid medications, and lower overall healthcare costs.

Introduction

Considering the high prevalence of low back pain (LBP),[1] it is not surprising that the condition accounts for 2.5% - 3% of all physician visits in the United States,[2-4] and is responsible for substantial healthcare spending. Annual direct healthcare costs were

estimated at over 85 billion dollars nationally in 2005, a 65% increase from 1997.[5] Despite increasing expenditures, the prevalence of chronic, disabling LBP is increasing.[5,6]

Most patients with LBP initially access healthcare through primary care.[7,8] Decisions in this setting likely have substantial impact on outcomes and costs.[9] Defining optimal primary care management has proven elusive, and wide variations in practice have been observed for decisions such as medications, imaging, and referrals including physical therapy[10-12] Practice guidelines generally recommend delaying referral for physical therapy for several weeks following initial consultation.[13,14] Rationale for this recommendation is that most patients recover rapidly, and intervening quickly would waste resources and could impede recovery for some by excessively "medicalizing" the condition.[15,16] Delaying physical therapy is questioned by studies suggesting reduced costs or improved outcomes with early use.[8,17] In practice, many patients are managed with early physical therapy instead of the recommended initial waiting period.[18]

The value of referring newly consulting patients with LBP from primary care to physical therapy likely depends on both the timing of referral as well as the content of care delivered. There appears to be wide variation in physical therapy care provided to patients with LBP.[19,20] Guidelines recommend an active approach with the focus on strategies to help patients maintain and improve activity levels.[21] Adherence to this recommendation has been associated with improved outcomes and lower subsequent healthcare utilization and costs.[22,23]

Further research is needed to examine implications of the decision to refer new LBP consulters from primary care to physical therapy, particularly the impact of timing and content of care. Purposes of this study were to describe utilization of physical therapy by primary care physicians for patients with a new consultation for LBP and evaluate the impact of the timing and content of physical therapy care on subsequent healthcare utilization and costs.

MATERIALS and METHODS

Description of the Data Source

Data source for this study was Mercer HealthOnline®, a multi-vendor data warehouse maintained by Mercer Health and Benefits, LLC (San Francisco, California). The database links claims and demographic data using anonymous coded numbers to protect patient privacy. The database stores up to three years of history and is updated monthly via an electronic feed from each data supplier. The database currently reflects the combined experience of more than 2 million members of employer-sponsored health plans. Project data had no identifying information. The project was approved by the xxxxxx Institutional Review Board.

Identification of the Study Sample

We identified patients with a new consultation with a primary care physician with a principle LBP diagnosis from November 1, 2007 through January 31, 2009. Date of the new consultation was defined as the primary care index date. A LBP diagnosis was

identified when a LBP-related ICD-9 code was the primary diagnosis (see Appendix Table 1, Supplemental Digital Content 1, http://links.lww.com/BRS/A672). Patients had to be continuously eligible within the database for 6 months before and 18 months after the index date. Only the first eligible index date for an individual patient was included. Further eligibility requirements were; age between 18-60 years on the index date, no claims with a LBP-related ICD-9 code for 6 months preceding the index date, a co-morbid diagnosis at the index date that could be a non-musculoskeletal source of LBP (e.g., kidney stones, urinary tract infection, etc.) (see Appendix Table 2, Supplemental Digital Content 1, http://links.lww.com/BRS/A672), or a prior history of spinal surgery based on the presence of related CPT-4 codes at any time prior to the index date (see Appendix Table 3, Supplemental Digital Content 1, http://links.lww.com/BRS/A672).

Covariate Variables

We recorded the following at the index date; patient's age and gender, co-payment for the index visit, employment status (active, retiree, long-term disability (LTD), or other), and geographic region (Northeast (CT, DC, MA, ME, NH, NJ, NY, PA, RI, VT), South (AL, AR, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV), Midwest (IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI), or West (AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY). The type of insurance plan was categorized within the database as a health maintenance organization (HMO) which is generally characterized by requirements for in-network services and referral for care through a primary care provider, a preferred provider organization (PPO) which typically provides more flexibility in choice of providers, point-of-service (POS) which are typically seen as

hybrids of HMO and POS plans with higher co-payments for out-of-network services, a high deductible health plan (HDHP) with low premium costs but high deductibles, or other.

We recorded co-morbid healthcare conditions within a 6-month period preceding the index date. We recorded the total number of unique ICD-9 diagnoses and the number of prescription medications based on unique Generic Product Identifiers (GPI8). We recorded if a hospitalization occurred for any reason, if opioids were prescribed, and total costs for all services during the period including inpatient, outpatient and prescriptions. We identified co-morbid conditions that may influence LBP prognosis including mental health (depression, anxiety, or other psychotic disorders), neck/thoracic pain, or fibromyalgia by identifying relevant ICD-9 codes.(see Appendix Table 4, Supplemental Digital Content 1, http://links.lww.com/BRS/A672)

Physical Therapy Utilization

We considered a 90-day period after the primary care index date to identify physical therapy utilization. If a physical therapy visit occurred with a LBP-related ICD-9 during this period the patient was defined as utilizing physical therapy. Patients with both physical therapy and chiropractic utilization during this period were not included in further analyses. Patients utilizing physical therapy within 90 days were categorized as receiving early physical therapy if the initial visit occurred $\leq$ 14 days from the primary care index date. We selected a 14-day period to represent a time frame that would clearly link the initiation of physical therapy to the primary care index date with low likelihood

of intervening treatment. If the visit occurred between 15-90 days from the index date the patient was categorized as receiving delayed physical therapy.

Physical therapy content was examined using Current Procedural Terminology (CPT) codes associated with all visits received during the physical therapy episode of care. An episode of care was defined as the number of days between initial and final visits. If no visits occurred for more than 30 consecutive days the episode of care was considered complete. If only one physical therapy visit was received the patient was not included in the analysis of content of care because these patients did not have an adequate number of visits over which to judge the content of the episode of care. We examined CPT codes to determine adherence to the guideline recommendation for active physical therapy treatment[21] using procedures described elsewhere.[23] Briefly, each CPT code at each visit was categorized as active, passive, or allowed. Active codes were those consistent with guideline recommendations (e.g, therapeutic exercise, self-training management, etc.). Passive codes were those indicating procedures inconsistent with guideline recommendations (e.g., hot/cold packs, ultrasound, etc.). Allowed codes included evaluation and equipment codes. Numbers of active and passive codes were totaled for visits during the first 14 days of the episode of care (phase I); and beyond 14 days (phase II). For each phase, the active percentage was calculated as: (number of active codes / (number of active codes + number of passive codes) * 100%). Adherence required the active percentage within each phase to be $\geq$ 75%, and each visit to include $\geq$ 1 active code, otherwise the episode of care was considered non-adherent.

Outcome Variables

We examined an 18-month period beginning with the index date to determine healthcare utilization and costs. We recorded utilization of the following when related to a LBP ICD-9 code: advanced imaging (MRI or CT), additional physician visits, lumbar spine injection, major lumbar surgery (discectomy, laminectomy, rhizotomy or fusion), and opioid medication use. We recorded costs during this period for expenditures in the following categories when related to a LBP ICD-9 code; diagnostic/imaging procedures, physician office visits, surgical/injection procedures, inpatient non-surgical costs, emergency room visits, and prescription medications. Any other healthcare costs (including physical therapy) related to a LBP ICD-9 code was recorded. Total LBP-related healthcare costs were calculated as the sum of all categories. Non-LBP healthcare costs during the 18-month period were recorded.

Data Analysis

Descriptive statistics were calculated. Multivariate logistic regression was used to identify factors associated with physical therapy utilization considering all covariates as potential predictors. We further examined descriptive variables, subsequent healthcare utilization and costs (LBP-related and non-LBP-related) for patients utilizing physical therapy based on the timing (early or delayed) and content (adherent or non-adherent) of care. Utilization outcomes were compared using odds ratios with 95% confidence intervals. We examined the relationship between total LBP-related costs and physical therapy utilization using multivariate linear regression controlling for all covariates.

RESULTS

76,967 continuously-eligible patients were identified with a primary care visit for LBP, of whom 32,070 (41.7%) were included (figure 1). Physical therapy was utilized within 90 days for 2,234 (7.0%). The mean number of physical therapy visits was 6.4 (sd = 5.1). Both physical therapy and chiropractic was utilized by 157 patients (0.49%). Baseline characteristics are provided in table 1.

Predictors of Physical Therapy Utilization

Predictors of physical therapy utilization were evaluated using 31,482 patients (98.2%) with complete data. Significant predictors were higher index visit co-payment (adjusted odds ratio (aOR) = 1.02, p=0.022), not receiving long-term disability (aOR = 0.21, p=0.04), having more diagnosis codes at the index visit (aOR = 1.04, p<0.001), and not having co-morbid neck/ thoracic pain (aOR = 0.76, p<0.001). Geographic region predicted utilization. With Midwest as the reference, utilization was predicted by living in the Northeast (aOR = 1.59, p<0.001) or West (aOR = 1.61, p<0.001), and not living in the South (aOR = 0.82, p=0.004).

Timing of Physical Therapy Utilization

Median time to physical therapy was 14 days (interquartile range: 6, 33). 1,102 (53.1%) patients were categorized as receiving early physical therapy, and 975 (46.9%) received delayed physical therapy. Patients receiving early physical therapy were less likely to be

taking opioids at index visit (p = 0.023). Differences were evident based on insurance plan. Of patients utilizing physical therapy with a PPO plan (n=1,493), a higher percentage received early physical therapy (n=803, 53.4%) compared to patients with an HMO plan (n=159), of whom 71 (44.7%) received early physical therapy (p=0.028). Differences based on geographical region were present. Patients utilizing physical therapy in the Midwest had a higher percentage with early physical therapy (n=189, 58.7%) compared to the South (n=274, 49.3%) (p=0.007).

Content of Physical Therapy Initial Management

Of 2,234 patients receiving physical therapy, 317 (14.2%) received one visit. Of the remaining 1,917 patients, 413 (21.5%) were categorized as adherent to the recommendation for active treatment, and 1,504 (78.5%) were non-adherent. Patients receiving adherent care were more likely to be male (p=0.004) and had fewer prescription medications at the index visit (table 1). Rates of adherence differed geographically, with higher percentage of patients utilizing physical therapy receiving adherent care in the Midwest (27.4%) and South (26.0%) than in the Northeast (16.8%) or West (18.1%) ($p<0.05$).

Subsequent Healthcare Utilization and Costs

Healthcare utilization is detailed in table 2. As compared with delayed physical therapy, patients with early physical therapy had an decreased likelihood of advanced imaging (OR = 0.34, 95% CI: 0.29, 0.41), additional physician visits (OR = 0.26, 95% CI: 0.21, 0.32), major surgery (OR = 0.45, 95% CI: 0.32, 0.64), lumbar spine injections (OR =

0.42, 95% CI: 0.32, 0.64), and opioid medications (OR = 0.78, 95% CI: 0.66, 0.93) (figure 2). Relative to patients receiving non-adherent care, those receiving adherent physical therapy had a decreased likelihood of surgery (OR = 0.61, 95% CI: 0.38, 0.98) and receiving injections (OR = 0.66, 95% CI: 0.48, 0.91) (figure 3). Subsequent healthcare costs during the 18 month follow-up period are outlined in table 3. As compared to patients with delayed physical therapy, total LBP-related costs for patients receiving early physical therapy were an average $2736.23 lower (95% CI: 1810.67, 3661.78). For patients receiving adherent versus non-adherent physical therapy, total LBP-related costs were an average $1374.30 lower (95% CI: 202.28, 2546.31).

DISCUSSION

This study evaluated a large sample of patients newly consulting a primary care physician for LBP. Physical therapy utilization was predicted by patient-related variables. Substantial geographic variation was observed. Despite guideline recommendations to delay physical therapy, about half the patients receiving physical therapy did so within 2 weeks. Use of physical therapy was associated with higher LBP-related costs over an 18-month period. Among patients utilizing physical therapy, we found strong associations between the timing of physical therapy and subsequent healthcare utilization and LBP-related costs. Patients with early physical therapy had decreased likelihood of advanced imaging, additional physician visits, surgery, injections and opioid use. We identified weaker associations based on the content of physical therapy care.

Geographic variation in physical therapy utilization is consistent with reports of other LBP interventions including imaging, opioids, surgery, and injections.[24-28] Reasons underlying geographic variation are likely numerous and cannot be confirmed from this study. Other research has identified provider density as a factor related to utilization of LBP services.[26] Utilization of MRI has been related to physician ownership of the equipment.[29] We were unable to determine physical therapist density within regions, or the ownership of physical therapy clinics. We found the highest rates of physical therapy utilization in the Northeast and West, with rates more than double for the South. The Northeast is reported to have the lowest rates of surgery and injections for LBP, with highest utilization of these procedures in the Midwest and South respectively.[24,26] Viewed collectively with our results, it does not appear that regional differences are attributable to an overall more aggressive attitude towards management of LBP in certain areas. Instead, it seems that preferred management patterns may differ regionally. Further research should explore this hypothesis and implications of different management patterns on outcomes and costs

Physical therapy utilization in this sample was low (7%), but consistent with other reports from large national databases.[4,8,30] We found a majority of patients who went to physical therapy did so quickly (within 2 weeks) after the primary care visit. A similar pattern has been reported in Medicare enrollees with a new consultation for LBP,[8] with 8.9% receiving physical therapy within 90 days, of whom 74.2% received care within 4 weeks. It appears that despite recommendations against early referral, when physical therapy is used for patients with LBP it often occurs quickly after initial consultation. This practice

may be justified by emerging evidence. We found early physical therapy was associated with reduced risk of subsequent surgery, injections, physician visits, opioid use, and advanced imaging, with a corresponding reduction in overall LBP-related medical costs relative to delayed physical therapy. These findings are consistent with those reported for Medicare patients,[8] suggesting similar risks accompanying delayed referral across the age spectrum.

There are several possible explanations for associations between physical therapy timing and outcomes. Early physical therapy attendees may be those with less fear or catastrophizing ideations related to LBP, and these beliefs may be responsible for better outcomes.[31] Consultation with any provider, however, has been related to psychosocial factors such as low mood or diminished self-perception of coping ability,[32,33] suggesting individuals seeking both primary care and physical therapy are likely those lacking confidence in their ability to self-manage. Physical therapy may contribute to promoting a greater sense of self-reliance in managing LBP and confidence in a positive outcome. The importance of developing these attributes of self-efficacy is emerging.[34] If physical therapy assists in developing self-efficacy, it is reasonable to expect it would have greater impact when implemented very early, before negative expectations have become reinforced and entrenched. This hypothesis may also help explain stronger associations between timing, versus content, of physical therapy care, as the specific activities within physical therapy may not be as important as the positive attitudes it promotes. Alternatively, this finding could reflect the insufficiency of the standard by which we judged the content of care. Randomized trials report that matching specific interventions

to patients with particular clinical characteristics can improve the outcomes of physical therapy for patients with LBP.[35,36] More detailed examination of the content of physical therapy and its adherence to specific clinical decision-making evidence may reveal a greater impact on outcomes.

Contrary to studies showing positive associations between early physical therapy and subsequent healthcare utilization, early use of MRI or opioids have demonstrated the opposite relationships, increasing risks for future utilization.[37-39] Use of these strategies early in the course of care may have the detrimental effects of decreasing patients' optimism for recovery or sense of control over symptoms. Several studies have found providing information on MRI results to patients with acute LBP diminishes patients' sense of well-being.[40,41] The value of early physical therapy may be partly attributable to providing an alternative, or counter-balance, to management strategies that foster a sense of dependency in the patient. Additional research evaluating the factors underlying these observations is needed; however it is increasingly evident that initial management decisions following a new LBP consultation can have profound implications for outcomes and downstream costs.

Although this study found associations between physical therapy timing and outcomes, use of physical therapy was associated with higher LBP-related costs and increased utilization of surgery and advanced imaging in particular relative to the overall sample. These findings may reflect differences in severity and other important prognostic indicators such as sciatica and psychosocial factors[42] that we were unable to include. It

may be that among patients with LBP who are at increased risk of persistent symptoms, early use of physical therapy could reduce overall costs, however this hypothesis could not be tested in this study. The most cost-effective management strategy would be expected to occur if, after medical red flags or emergency conditions are identified and appropriately referred, patients likely to benefit from physical therapy could be accurately identified by primary care providers and referred early, while those at low risk are managed within primary care. Screening tools designed to facilitate identification of patients likely to benefit from early physical therapy have been developed and show some promise.[43]

This study should be considered in light of additional limitations. Coding errors may have existed within our dataset. We did not include pharmaceutical costs, which contribute a small, but growing percentage of LBP-related costs.[5,44] We did not measure indirect or out-of-pocket costs for treatments such as complementary care, which is common for LBP.[45] We were unable to measure patient-centered outcomes such as pain or satisfaction with care. We only included patients referred from a physician to physical therapy. Almost all states permit direct access to physical therapy without a physician referral, and direct access has been associated with reduced costs as compared to physical therapy episodes of care that begin with a physician referral.[46]

Conclusion

Utilization of physical therapy within 90 days for newly consulting patients with LBP was generally low, and varied across geographic regions. The timing of physical therapy

utilization was strongly related to subsequent healthcare utilization and costs, with early use associated with reduced risks of advanced imaging, surgery, injections, opioid use, and lower overall healthcare costs as compared with delayed use.

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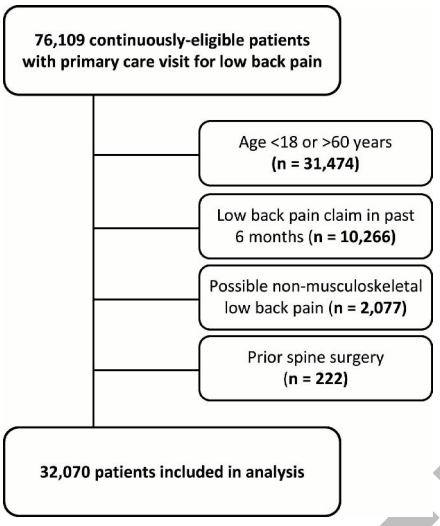

Figure 1. Reasons for exclusion of patients from the analysis.

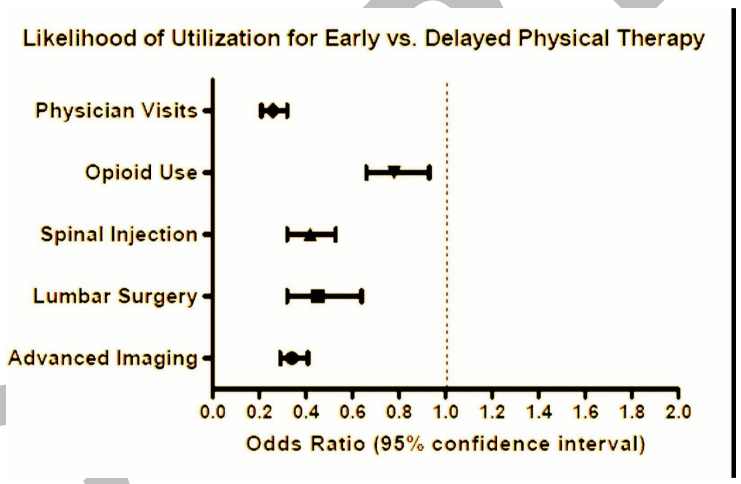

Figure 2. Likelihood of receiving specific services during the 18 month follow-up period based on timing of physical therapy.

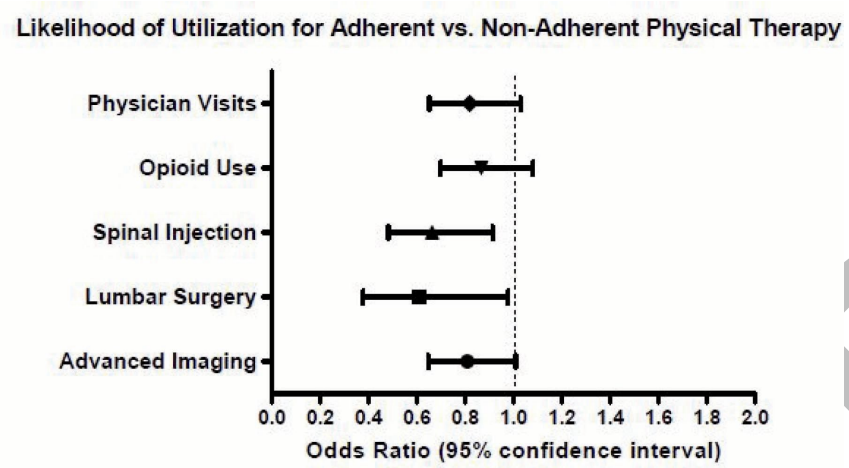

Figure 3. Likelihood of receiving specific services during the 18 month follow-up period based on content of physical therapy.

APPENDIX TABLE 1 – ICD-9 Codes used to Identify Low Back Pain

Code	Description	Code	Description
721.3	Lumbosacral spondylosis without myelopathy	724.5	Backache, unspecified
722.1	Lumbar disc displacement	756.11	Spondylolysis, lumbosacral region
722.52	Lumbar/ lumbosacral disc displacement	756.12	Spondylolesthesis
722.73	Lumbar disc disease with myelopathy	846.0	Sprain - lumbosacral
722.93	Other disc disorder – lumbar region	846.1	Sprain - sacroiliac
724.02	Spinal stenosis-lumbar	846.8	Sprain – other specified sites of sacroiliac region
724.2	Lumbago	846.9	Sprain – unspecified site of sacroiliac region
724.3	Sciatica	847.2	Sprain – lumbar region
724.4	Thoracic or lumbosacral neuritis or radiculitis, unspecified	847.3	Sprain – sacrum

APPENDIX TABLE 2 - ICD-9 codes used to Identify Non-Musculoskeletal Reasons for Low Back Pain

ICD-9 code	Description
592.xx	Calculus of kidney
574.2	Calculus of gallbladder without mention of cholecystitis
599.0	Urinary tract infection, site not specified
V13.02	Urinary (tract) infection
140.xx – 239.xx	Neoplasms
V17.81, V82.81	Osteoporosis
344.6	Cauda equine syndrome
730.xx	Osteomyelitis, periostitis, and other infections involving bone
731.3	Major osseous deficit

APPENDIX TABLE 3 - CPT-4 codes used to Identify Prior Surgery for Low Back Pain

Code	Description
00630	Anesthesia for procedures in lumbar region; not otherwise specified.
00670	Anesthesia for extensive spine and spinal cord procedures.
20930	Allograft for spine surgery only; morselized.
20936	Autograft for spine surgery only; local, obtained from same incision.
22102	Partial excision of posterior vertebral component for intrinsic bony lesion, single segment; lumbar.
22103	Partial excision of posterior vertebral component for intrinsic bony lesion, single segment; each additional segment.
22224	Osteotomy of spine, including diskectomy, anterior approach, single segment; lumbar.
22226	Osteotomy of spine, including diskectomy, anterior approach, single segment; each additional segment.
22558	Arthrodesis, anterior interbody technique, including minimal diskectomy to prepare interspace; lumbar.
22585	Arthrodesis, anterior interbody technique, including minimal diskectomy to prepare interspace; each additional interspace.
22612	Arthrodesis, posterior or posterolateral technique, single level; lumbar
22630	Arthrodesis, posterior interbody technique, single interspace; lumbar
22802	Arthrodesis, posterior, for spinal deformity, with or without cast; 7 to 12 vertebral segments.
22840	Insert spine fixation device
22842 – 22844	Posterior segmental instrumentation; 3 – 6 vertebral segments thru 13 or more segments
22851	Apply spine prosthetic device
62287	Aspiration procedure, percutaneous, of nucleus pulposus of intervertebral disk, any method, single or multiple levels, lumbar.
63005	Laminectomy with exploration and/or decompression of spinal cord and/or cauda equine, without facetectomy, foraminotomy or diskectomy, (eg, spinal stenosis), one or two vertebral segments; lumbar, except for spondylolisthesis.
63011, 63012	Laminectomy with exploration and/or decompression of spinal cord and/or cauda equine, without facetectomy, foraminotomy or diskectomy, one or two vertebral segments; sacral or lumbar
63030	Laminotomy with decompression of nerve root(s), including partial facetectomy, foraminotomy and/or excision of herniated intervertebral disk; one interspace, lumbar.
63035	Laminotomy with decompression of nerve root(s), including partial facetectomy, foraminotomy and/or excision of herniated intervertebral disk; each additional interspace, cervical or lumbar.
63042	Laminotomy with decompression of nerve root(s), including partial facetectomy, foraminotomy and/or excision of herniated intervertebral disk, re-exploration; lumbar.
63047	Laminectomy, facetectomy and foraminotomy (unilateral or bilateral with decompression of spinal cord, cauda 28quine and/or nerve root(s)) , single vertebral segment; lumbar.
63048	Removal of spine lamina – add-on

63088 – 63091	Vertebral corpectomy, partial or complete, combined thoracolumbar approach with decompression of spinal cord, cauda equine or nerve root(s), lower thoracic or lumbar; each additional segment.
63185, 63190	Laminectomy with rhizotomy
63200	Laminectomy, with release of tethered spinal cord, lumbar.
63267, 63272	Laminectomy for excision or evacuation of intraspinal lesion other than neoplasm, extradural or intradural; lumbar.
63290	Laminectomy for biopsy/excision of intraspinal neoplasm; combined extra-intradural lesion, any level.
63303	Vertebral corpectomy, partial or complete, for excision of intraspinal lesion, single segment; extradural, lumbar or sacral by transperitoneal or retroperitoneal approach.
63047	Laminectomy, facetectomy and foraminotomy (unilateral or bilateral with decompression of spinal cord, cauda equine and/or nerve root(s)) , single vertebral segment; lumbar.
63048	Removal of spine lamina – add-on
64622	Destruction by neurolytic agent; paravertebral facet joint nerve, lumbar, single level.
64623	Destruction by neurolytic agent; paravertebral facet joint nerve, lumbar, each additional level.

APPENDIX TABLE 4 - ICD-9 codes used to Identify Co-Morbid Conditions

Code	Description
CO-MORBID MENTAL HEALTH CONDITIONS	
296.xx	Affective psychoses
297.xx	Delusional disorders
298.xx	Other nonorganic psychoses
300.xx	Neurotic disorders
301.xx	Personality disorders
308.xx	Acute reaction to stress
309.xx	Adjustment reaction
311.xx	Depressive disorders, not elsewhere classified
CO-MORBID NECK / THORACIC PAIN:	
721.0	Cervical spondylosis without myelopathy
721.1	Cervical spondylosis with myelopathy
721.2	Thoracic spondylosis without myelopathy
721.41	Spondylogenic compression of thoracic spinal cord
722.0	Displacement of cervical intervertebral disc without myelopathy
722.4	Degeneration of cervical intervertebral disc
722.51	Intervertebral disc disorder, thoracic or thoracolumbar region
722.71	intervertebral disc disorder without myelopathy – cervical
722.72	Intervertebral disc disorder without myelopathy, thoracic region
722.81	Post-laminectomy syndrome - cervical
722.91	other unspecified disc disorder – cervical region

723.xx	Other disorders of cervical region
724.1	Pain in thoracic spine
739.1	Non-allopathic lesions not otherwise specified – cervical region
805	Fracture of cervical spine without spinal cord injury
847.0	Sprains and strains of other, unspecified part of the back - neck
953.0	Injury to nerve root and spinal plexus - cervical
954.0	Injury to other nerves of trunk - cervical
CO-MORBID FIBROMYALGIA	
729.1	Myalgia and myositis, unspecified

	All Patients (n=32,070)	**Utilized Physical Therapy** (n=2,234)	**Timing of Physical Therapy** (n=2,077)		**Content of Physical Therapy** (n=1,917)	
			Early (n=1,102)	Delayed (n=975)	Adherent (n=413)	Non-Adherent (n=1504)
Age (mean, sd)	43.1 (10.1)	43.6 (9.9)	43.1 (10.2)	44.0 (9.5)	42.5 (10.3)	44.1 (9.7)
Gender (% female)	53.9%	54.2%	56.6%	53.0%	48.4%	56.4%
Index visit co-payment (mean, sd)	$26.56 (28.22)	$27.84 (30.10)	$28.55 (31.55)	$27.33 (28.59)	$28.93 ($34.33)	$27.95 ($29.43)
Insurance Plan						
PPO	70.5%	72.2%	72.9%	70.8%	71.2%	73.1%
HMO	8.6%	7.6%	6.4%	9.0%	6.5%	7.5%
POS	7.2%	6.3%	6.4%	6.4%	6.5%	6.2%
HDHP	3.0%	3.4%	3.4%	3.6%	5.1%	3.3%
Other	10.6%	10.6%	10.9%	10.3%	10.7%	10.0%
Employment status						
Active	97.3%	97.0%	96.8%	97.0%	96.9%	96.9%
Retiree	1.8%	2.1%	2.3%	1.8%	1.7%	2.2%
LTD	0.27%	0.090%	0.091%	0.10%	0.24%	0.07%
other	0.60%	0.90%	0.82%	1.0%	1.2%	0.80%
Geographic region						
Northeast	16.8%	21.9%	21.8%	22.8%	17.7%	23.9%
West	26.7%	35.4%	35.5%	33.7%	30.0%	36.6%
South	38.6%	27.1%	25.3%	29.5%	32.7%	25.2%
Midwest	18.0%	15.6%	17.4%	13.9%	20.0%	14.4%
Number of diagnosis codes (mean, sd)	6.5 (5.3)	7.1 (5.1)	7.0 (4.9)	7.1 (5.2)	6.8 (5.3)	7.3 (5.1)
Number of prescription medications (mean, sd)	5.5 (5.4)	5.6 (5.4)	5.5 (5.4)	5.7 (5.4)	4.8 (4.7)	5.9 (5.5)
Co-morbid mental health condition	9.6%	9.7%	9.5%	9.5%	7.7%	9.4%
Co-morbid fibromyalgia diagnosis	2.4%	2.4%	1.7%	3.0%	1.7%	2.6%
Co-morbid neck/thoracic spine condition	12.5%	11.1%	9.4%	11.7%	9.0%	11.8%
Narcotic use prior to index visit	31.4%	33.3%	30.5%	35.2%	30.8%	34.0%
Hospitalization prior to index visit	3.7%	3.7%	3.0%	4.6%	3.6%	3.7%
Total medical costs prior to index visit (mean, sd)	$3193.08 ($7672.62)	$3422.01 ($5403.82)	$3168.58 ($4581.94)	$3574.32 ($5772.12)	$2971.61 ($4795.07)	$3567.91 ($5635.93)
Number of physical therapy sessions (mean, sd)		6.4 (5.1)	6.9 (5.6)	5.8 (4.5)	5.3 (3.9)	7.9 (5.1)

Table 1. Characteristics of patients with new consultations in primary care with low back pain (PPO = preferred provider organization, HMO = health maintenance organization, POS = point of service, HDHP = High deductible health plan, LTD = long term disability)

	All Patients (n=32,070)	**Timing of Physical Therapy** (n=2,077)		**Content of Physical Therapy** (n=1,917)	
		Early (n=1,102)	Delayed (n=975)	Adherent (n=413)	Non-Adherent (n=1504)
Advanced Imaging (MRI or CT)	18.9%	29.4%	54.9%	38.7%	43.9%
Additional Physician Visits	44.1%	52.6%	81.0%	64.4%	68.8%
Lumbar Spine Surgery	2.5%	4.7%	9.9%	5.1%	8.1%
Lumbar Spinal Injections	7.1%	10.1%	21.2%	12.6%	17.8%
Opioid Medication Use	49.1%	49.1%	55.3%	49.6%	53.2%

Table 2. Utilization of specific services for low back pain in the 18 month period following the index primary care visit

	All Patients (n=32,070)	**Timing of Physical Therapy** (n=2,077)		**Content of Physical Therapy** (n=1,917)	
		Early (n=1,102)	Delayed (n=975)	Adherent (n=413)	Non-Adherent (n=1504)
Imaging Procedures	$291.12 (5.42)	$473.32 (63.92)	$807.20 (42.12)	$513.84 (46.82)	$701.14 (52.32)
Physician Visits	$209.54 (1.48)	$259.62 (9.76)	$411.76 (11.89)	$295.52 (14.33)	$357.15 (9.86)
Surgical/ Injection Procedures	$740.44 (36.84)	$1018.88 (170.65)	$2760.62 (381.27)	$1445.23 (486.37)	$1965.72 (229.42)
Inpatient Non-Surgical Procedures	$79.28 (11.13)	$65.00 (30.58)	$231.79 (64.52)	$162.31 (90.20)	$142.99 (37.81)
Emergency Room Visits	$19.83 (0.87)	$26.21 (4.89)	$25.22 (4.59)	$24.87 (6.94)	$28.61 (4.36)
Prescription Medication	$104.23 (3.01)	$80.41 (10.22)	$116.83 (11.27)	$76.43 (9.85)	$98.85 (9.61)
Other LBP-related Costs	$437.89 (8.11)	$1225.04 (52.10)	$1531.3 (67.01)	$1090.64 (89.06)	$1651.73 (53.07)
Total LBP costs	$1882.33 (44.58)	$3148.49 (228.90)	$5884.71 (429.92)	$3608.83 (533.49)	$4946.18 (277.19)
Non-LBP healthcare costs	$7892.53 (108.75)	$7169.22 (472.39)	$8430.44 (761.80)	$7254.82 (1155.66)	$7511.44 (402.09)

Table 3. Costs incurred over the 18 month period following the index primary care visit. Values represent mean (standard error).