

## Retrospective Analysis

# Effect of Provider Specialty on Medical Resource Utilization and Costs in Chronic Spinal-Pain Management

Peter S. Staats, MD<sup>1,2,4</sup>, Ricardo Vallejo, MD, PhD<sup>1</sup>, Nicolas C. Gasquet, MPH<sup>3</sup>, and Christine N. Ricker, MA<sup>3</sup>

From: <sup>1</sup>National Spine and Pain Centers, Rockville, MD; <sup>2</sup>World Institute of Pain, Winston-Salem, NC; <sup>3</sup>Medtronic Health Economics and Outcomes Research, Minneapolis, MN

Address Correspondence:  
Peter Staats, MD  
National Spine and Pain Centers  
11921 Rockville Pike Ste 505  
Rockville, MD 20852  
E-mail:  
peterstaats@hotmail.com

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**Background:** Poorly managed chronic spinal pain encumbers medical resources and drives healthcare costs, suggesting a target for improvement.

**Objectives:** To determine how specialist-care pathways influence healthcare costs in the first year after a referral for chronic spine pain.

**Study Design:** This was a retrospective cohort analysis of administrative claims from a large commercial health insurance provider, analyzing a 6-month baseline, a variable “pre-referral period,” and a one-year period of specialist care.

**Setting:** US patients covered by private commercial insurers.

**Methods:** Adult patients diagnosed with chronic, spine-related pain between July 2016 and February 2018 and under the active care of a specialist were eligible. Patients with neurological deficits or cancer-related pain were excluded. Patients were categorized based on sequence-dependent exposure to a pain specialist, a surgeon, or both specialties. Key measures were pain-related and all-cause medical resource use and costs and opioid prescription fills.

**Results:** Of 306,080 eligible patients (mean age 61.6; 61.5% women), 13% saw a pain specialist, 71% a surgeon, 7% a pain specialist then a surgeon, and 9% a surgeon then a pain specialist. Referral to a pain specialist alone was associated with lower resource use and per-patient adjusted cost savings of \$3,311 (pain-related) and \$6,447 (all-cause) compared to patients referred to a surgeon alone. The pain specialist pathway was associated with increased indicators of prescription opioid use.

**Limitations:** Cohort design constraints temper the results’ generalizability, given the need to simultaneously examine specialty pathway and medical resource incurred over the same time period.

**Conclusions:** We observed meaningful savings in cost and resource use when chronic spine-pain patients were managed by pain specialists. Pain-management referrals should be an element of a thoughtfully designed care pathway.

**Key words:** Chronic spinal pain, pain management, care pathway, spine surgery

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**P**ersistent or recurring back pain is one of the leading health care crises in the United States of America (US). Low back and neck pain are

associated with an estimated \$134.5 billion (95% CI, \$122.4 - \$146.9 billion) in spending (1), and overall, recurring back pain costs the public more than

cancer and heart disease combined (2-4). Depending on its severity, chronic pain can exert long-term negative effects on a person's quality of life, affecting participation in activities, relationships, work, years lived in disability, and overall healthcare costs (2,5-7).

Patients seeking care for chronic spinal pain often begin with their primary care provider; subsequent referral pathways may include chiropractic care, pain management, or a neurosurgeon or orthopedic surgeon. Each specialty evaluates and manages pain through a different lens and may present a different menu of therapeutic strategies, with potentially disparate impacts on clinical outcomes and costs of care. For example, while a surgeon might perform discectomy, laminectomy, foraminotomy, decompression, or instrumented fusion, a pain specialist may select among second- and third-line management options such as epidural and transforaminal injections, radiofrequency ablation, spinal cord stimulation, targeted drug delivery, and decompressive procedures (9-12).

Multiple studies have analyzed costs for various interventional pain therapies (9,10,13); however, an analysis of total costs associated with specific specialist pathways and incurred by patients covered by commercial insurance has yet to be explored. We sought to understand how different specialty care pathways affected the cost of managing chronic spinal pain. Our hypothesis was that medical resource use and costs in the first year of specialty care would differ when patients were managed by a pain management specialist compared to those under the care of a surgeon.

To test our hypothesis and gain insight into how care differed in those scenarios, we analyzed cost differences between referral pathways using data from a nationally representative sample of commercially insured, US patients with newly diagnosed spinal conditions who subsequently developed chronic spinal pain.

## METHODS

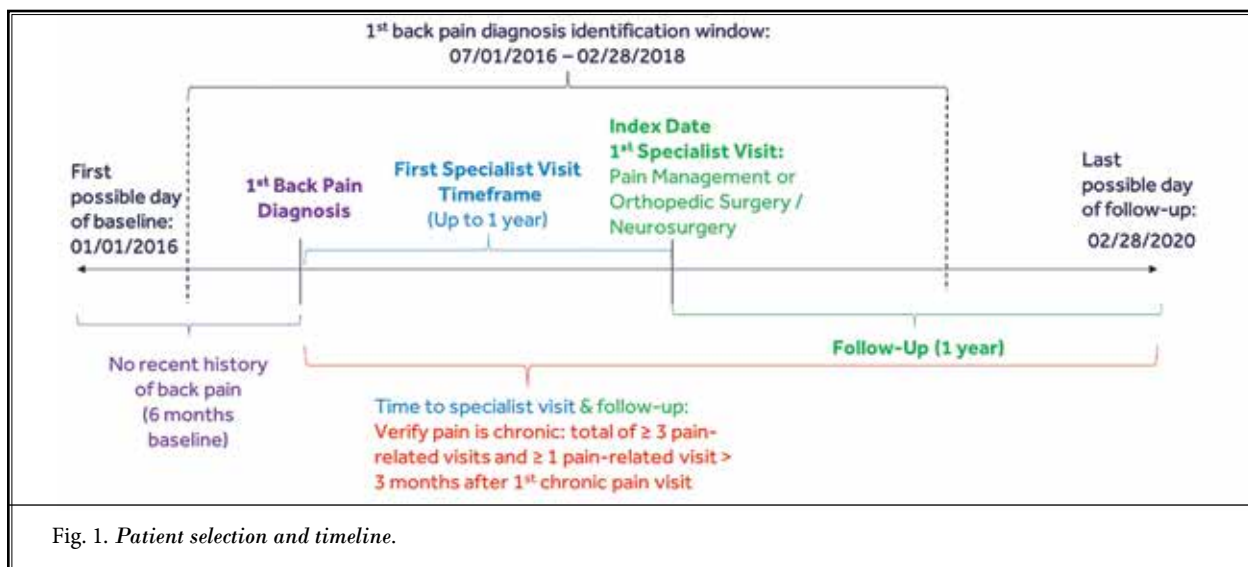
### Data Sources

This study used administrative claims data from a large commercial insurer inclusive of approximately 50 million patients (2016 - 2020). The database is a deidentified, HIPAA-compliant, closed system of administrative claims, and therefore, this study was not subject to Institutional Review Board approval.

### Study Time Periods and Definitions

For the purposes of this study, a "surgical specialist" was defined as a neurosurgeon or orthopedic surgeon. A "pain management specialist" (shortened hereafter to "pain specialist") included those with the provider category of pain medicine or interventional radiology (specialty codes 72 and 09, respectively).

For each patient, the first date with a primary diagnosis of a painful spinal condition was identified (Fig. 1). The "baseline period" was defined as the 6-month period before the first back pain diagnosis. The "pre-referral period" was defined as the period beginning on the date of the first diagnosis visit and ending on the day before the first visit to a specialist. This period



was limited to a maximum of one year; patients under general care for more than one year without referral to a specialist were excluded from analysis. The “specialist index visit” was defined as the date of the first visit with a pain management specialist or surgical specialist. The “follow-up period” began on the date of the specialist index visit through the earliest of death or one year. The last possible follow-up was set as February 2020 to eliminate potentially confounding effects of COVID-19 on specialist care.

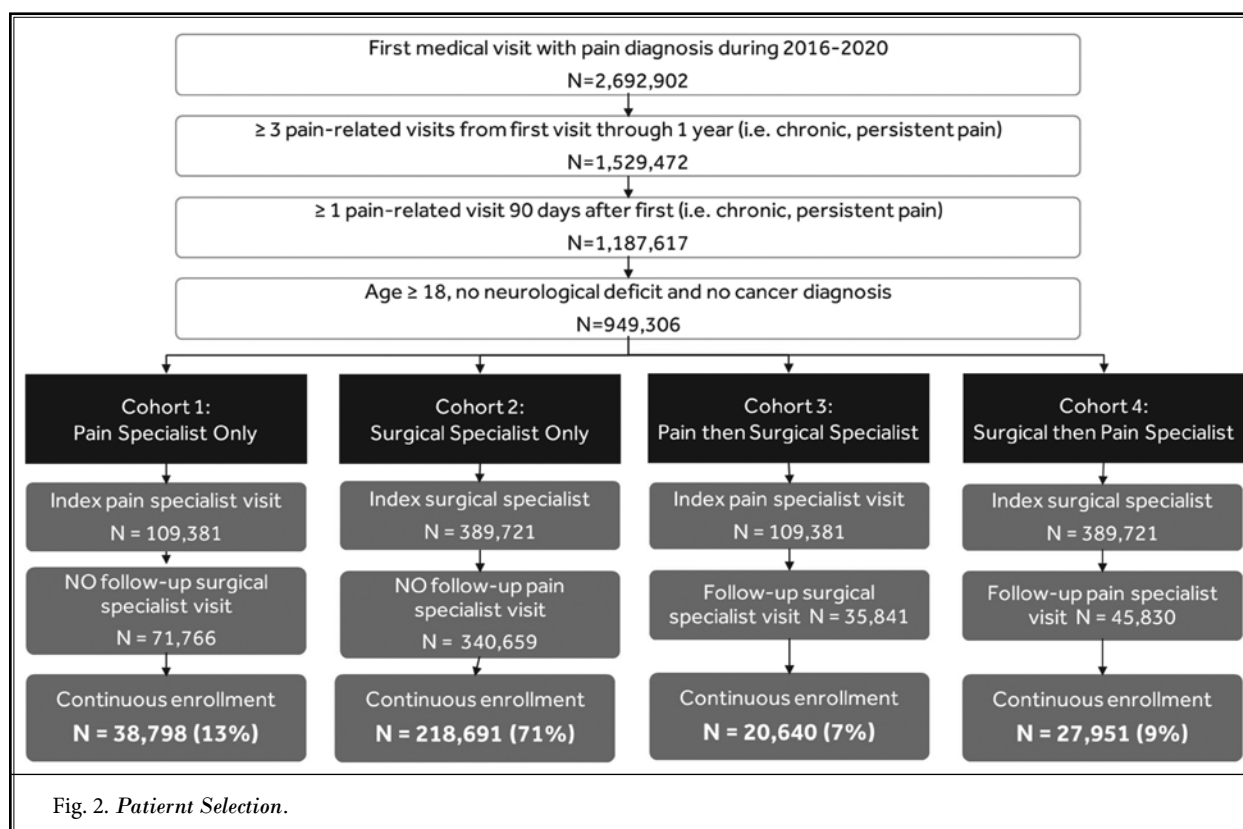
### Patient Selection

Patients aged 18 or older, who were first diagnosed with chronic, spine-related pain between July 2016 and February 2018, and who completed follow-up by February 28, 2020, were eligible (Fig. 1). Pain-related medical visits and costs were defined as those associated with a primary or secondary diagnosis of spinal conditions causing back pain (Appendix Table 1) or pain diagnosis (Appendix Table 3), or both. To select patients with a spine condition causing chronic pain (as opposed to acute pain), patients were required to have 3 or more pain-related visits from the time of first diag-

nosis through the end of follow-up. To further capture the persistence of pain, we required at least one pain-related visit within 90 days after the first diagnosis.

Patients with any pain-related visits in the baseline period (i.e., prior to the first-diagnosis visit) were excluded. Patients with a diagnosis of neurological deficits, including foot drop, neurogenic bladder dysfunction, myelopathy, or other spinal neurogenic syndromes (Appendix Table 2) were also excluded, given these could be indicative of a spinal condition that may require more immediate surgical intervention. Patients with a diagnosis of cancer or neoplasm-related pain anytime during the study period were also excluded to avoid the confounding effect of the high costs and strong opioid prescriptions associated with treatment for cancer-related pain. All patients were required to show evidence of continuous health plan enrollment during the entire study period, with an allowance for a 30-day gap in enrollment.

Patients were assigned to 4 mutually exclusive study cohorts based on the specialist(s) seen between the specialist index visit and completion of follow-up (Fig. 2). These were patients who saw only a pain specialist and no surgical specialist; those who saw only a



surgical specialist; those who first saw a pain specialist and later a surgical specialist; and those who first saw a surgical specialist and later a pain specialist. Patients who were managed only by a primary care physician without specialist care were excluded on the assumption that patients whose chronic back pain was managed by primary care alone were a different and potentially less severe population than those managed by a specialist.

### Study Measures

Baseline demographic characteristics such as age, gender, geographic region, specific spinal-pain related diagnoses, and Charlson Comorbidity Index (CCI) score were reported as of the initial diagnosis visit. The CCI score, a validated measure of comorbidity burden, was calculated from patient data as has been described previously (14).

Medical resource use was analyzed as the proportion of patients with any visit to an inpatient or outpatient hospital, emergency department (ED), ambulatory surgical center (ASC), or office setting during follow-up and the number of visits per patient to these settings. Given the difficulty in retrospectively differentiating visits related to pain management from those for treatment of the underlying condition causing pain and from other reasons that also included pain management, we chose to evaluate both "pain-related" as well as "all-cause" (visits for any reason) medical resource utilization.

Prescription medications filled by a pharmacy and billed to the payer were also evaluated. Because patients are prescribed medications other than opioids for tolerability issues, pain-related medications such as pregabalin or gabapentin anticonvulsants, duloxetine antidepressant, and the muscle relaxants methocarbamol, cyclobenzaprine, tizanidine, and carisoprodol were also evaluated.

"Costs," in this analysis, refers to the sum of payer reimbursements and the amount patients paid out of pocket, including copayments, coinsurance, and deductibles. All costs were inflated to 2020 USD. Sensitivity analyses were performed comparing pain-related and all-cause costs among the collapsed cohorts 1 and 3 ("pain specialist first") and 2 and 4 ("surgeon first"), thus evaluating trends according to which specialty was seen first, regardless of other specialists seen during follow-up.

Also evaluated during the follow-up period was the proportion of patients who received MRI, CT, x-ray, or other imaging; the proportion with at least one opioid prescription fill in the year prior to or following the specialist index visit, and average daily morphine mil-

ligram equivalents (MME). Prescription fills were used as a surrogate measure of opioid utilization and were stratified according to the Centers for Disease Control and Prevention (CDC) opioid-dose categories for "low" (< 50 mg/day), "moderate" (50-89 mg/day), and "high" ( $\geq$  90 mg/day) use (15).

### Analytical Methods

Mean (standard deviation [SD]) and median (interquartile [IQR]) were reported for continuous variables, and percentages were reported for categorical variables. Statistical significance testing across cohorts was performed using the Chi-square test for binary and categorical measures and one-way analysis of variance (ANOVA) for continuous measures for comparisons that involved all 4 cohorts. Similarly, for the comparison of a subset of cohorts, the Chi-square test was used for binary or categorical measures. Statistical significance was defined at the 95% confidence level.

Pain-related and all-cause costs were presented as both unadjusted and adjusted amounts. To account for other factors potentially influencing cost prior to the end of the follow-up period, and to isolate the independent effect of physician specialty on total one-year follow-up costs, generalized linear models (GLM) with a Gamma distribution and log-link were run, controlling for the covariates of age, gender, geographic region, and specific spine-related pain diagnosis. Analyses were conducted using the Instant Health Data platform (Panalgo, Boston, MA) and R version 3.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

### Role of the Funding Source

Medtronic, Plc. provided funds for professional medical writing.

## RESULTS

### Demographics and Clinical Characteristics

After applying patient selection criteria (Fig. 2), 306,080 patients were included for analysis. Of these, 13% saw only a pain specialist, 71% only a surgical specialist, 7% a pain specialist first followed by a surgical specialist, and 9% a surgical specialist followed by a pain specialist. While most of the differences in baseline demographic characteristics between cohorts were statistically significant (Table 1), they were small and not clinically meaningful. Mean patient age at baseline ranged from 60 to 62 years, and 60% to 63% of patients were female ( $P < 0.0001$ ). The mean CCI score ranged from 0.7 to 0.8 ( $P < 0.0001$ ), indicating a

## Provider Specialty in Chronic Spinal-Pain Management

Table 1. Demographic and clinical characteristics of study population at initial diagnosis.

	Cohort 1 pain only	Cohort 2 surgeon only	Cohort 3 pain then surgeon	Cohort 4 surgeon then pain	P Value*
N	38,798	218,691	20,640	27,951	
Age					
Mean	59.8	62	61.8	60.5	< 0.0001
SD	14.2	14.9	13.3	14.3	
Median	60	65	63	61	
IQR	51-70	53-73	53-71	51-71	
Female	60.7%	61.6%	63.2%	60.4%	< 0.0001
Region					
Midwest	16.4%	27.0%	19.2%	19.4%	< 0.0001
Northeast	8.3%	10.7%	9.1%	9.7%	
South	57.7%	47.8%	56.3%	55.2%	
West	17.6%	14.5%	15.5%	15.7%	
Charlson Comorbidity Index score					
Mean	0.8	0.8	0.8	0.7	< 0.0001
SD	1.3	1.3	1.2	1.2	
Median	0	0	0	0	
IQR	0-1	0-1	0-1	0-1	
Spinal pain-related diagnoses (%)					
Dorsalgia or cervicalgia back or neck pain	75.8%	83.5%	76.2%	81.7%	< 0.0001
Radicular syndrome	54.1%	42.6%	59.8%	51.5%	< 0.0001
Spondylosis	51.8%	40.5%	53.8%	45.1%	< 0.0001
Thoracic lumbar lumbosacral disc disorders	42.4%	40.2%	45.2%	45.1%	< 0.0001
Cervical disc disorder	12.9%	14.9%	13.7%	14.9%	< 0.0001
Failed back surgery syndrome	12.6%	3.8%	14.8%	6.7%	< 0.0001
Spinal stenosis	11.7%	17.3%	14.5%	17.5%	< 0.0001
Spondylolisthesis	5.8%	12.3%	8.1%	13.4%	< 0.0001
Spinal trauma	3.5%	7.0%	3.4%	5.4%	< 0.0001
Spondylolysis	2.6%	2.1%	2.8%	2.6%	< 0.0001
Complex regional pain syndrome I	1.3%	0.4%	1.3%	0.7%	< 0.0001
Complex regional pain syndrome II	0.3%	0.2%	0.4%	0.3%	< 0.0001
Non-diabetic neuropathy	0.2%	0.2%	0.2%	0.2%	0.2379
Any low back-pain diagnoses	85.6%	79.3%	85.9%	82.3%	< 0.0001

\*P values were calculated for comparison of all 4 cohorts simultaneously.

Age and region were assessed at the index admission date, Charlson Comorbidity Index score and spinal pain diagnoses were assessed during baseline through index date.

Pearson's Chi-square test was used for categorical variables, One-Way ANOVA for continuous variables.

low comorbidity burden. Of the specific spinal-pain related diagnoses, general back or neck pain (dorsalgia/cervicalgia) were most common, followed by radicular syndromes and spondylosis.

### Medical Visits

Fewer patients whose care was managed only by

a pain specialist experienced a pain-related inpatient hospitalization during the one-year follow-up period, compared to those seen only by a surgeon (8.2% versus 17%;  $P < 0.0001$ ), while patients whose care was managed by both specialties experienced similar rates of pain-related inpatient hospitalization (21.4% to 20.3%). Fewer patients managed by a single specialist

experienced a pain-related ED visit (15.6% and 16.3%) relative to those with care managed by both specialties (23.4% and 19.8%),  $P < 0.0001$ .

### Resource Use Analysis

Fewer patients managed only by a pain specialist

underwent any spine imaging in follow-up (38.7%) compared to those managed by a surgeon alone (65.3%) or in combination with pain specialists (66.6% to 76.7%;  $P < 0.0001$ , Table 2). Additionally, the proportion of patients who underwent a spinal fusion procedure was lower among those managed by a pain physician alone

Table 2. Resource use details.

	Cohort 1 pain only	Cohort 2 surgeon only	Cohort 3 pain then surgeon	Cohort 4 surgeon then pain	P value*	P value‡
N	38,798	218,691	20,640	27,951		
Any back imaging in follow up (%)	38.7%	65.3%	66.6%	76.7%	< 0.0001	< 0.0001
Conditional number of back imaging visits						
Mean	1.5	2.3	2.3	2.6	< 0.0001	
SD	0.9	1.7	1.7	1.9		
Median	1	2	2	2		
IQR	1-2	1-3	1-3	1-3		
Proportion with surgery index through follow-up (%)						
Spinal fusion	0.3%	7.4%	7.2%	9.4%	< 0.0001	< 0.0001
Laminectomy	0.4%	8.0%	8.1%	9.8%	< 0.0001	< 0.0001
Any opioid prescription (%)						
In one year prior to 1st specialist visit	49.7%	33.8%	49.5%	40.7%	< 0.0001	< 0.0001
In one year after 1st specialist visit (including the 1st index visit)	53.4%	41.3%	60.3%	52.9%	< 0.0001	< 0.0001
Number of treated days with an opioid prescription in follow-up†						
Mean	179.4	85.3	155.5	108.6	< 0.0001	
SD	131.2	107.1	145.4	122.3		
Median	172	30	114	54		
IQR	44-318	10-123	30-279	15-179		
Average daily morphine milligram equivalents (MME) over one year prior to first specialist visit†						
Mean	39.1	15.7	31.2	19.5	< 0.0001	
SD	76.1	46.5	61.4	50.2		
Median	12.3	2	8.6	2.9		
IQR	2.2-44.3	0.6-9.9	1.6-34.4	0.8-14.7		
Average daily morphine milligram equivalents (MME) over follow-up†						
Mean	39.7	14.5	30.1	18.1	< 0.0001	
SD	64.5	38.9	51.5	41.4		
Median	15.9	2.5	9.4	3.8		
IQR	3.3-50.3	0.8-9.9	2-37	1.2-16		
CDC opioid dose category over follow-up†						
Low (< 50 mg/day)	74.9%	92.4%	80.9%	90.1%	< 0.0001	< 0.0001
Moderate (50-89 mg/day)	12.9%	4.1%	10.3%	5.5%		
High (≥ 90 mg/day)	12.2%	3.6%	8.8%	4.4%		

\*P values were calculated for comparison of all 4 cohorts simultaneously.

‡P value calculated comparing the pain-only cohort to the surgeon-only cohort.

†Among those with ≥ 1 opioid prescription in the time period.

Pearson's Chi-square test was used for categorical variables, One-Way ANOVA for continuous variables.



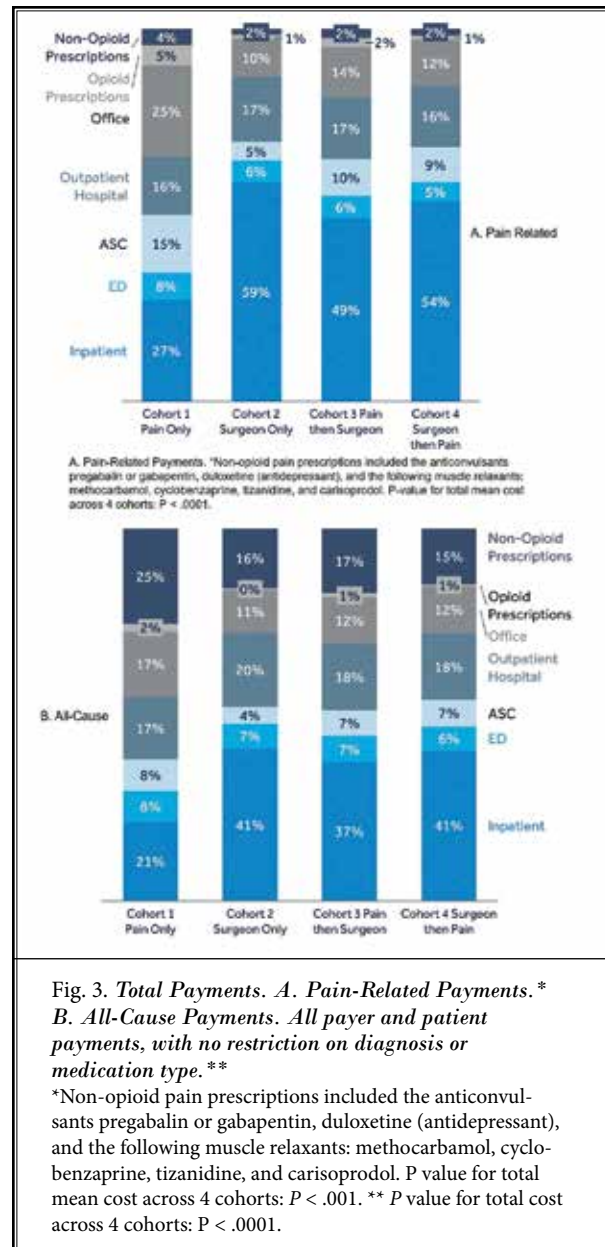
(0.3%) versus a surgical specialist alone (7.4%) or with a pain specialist (7.2% to 9.4%;  $P < 0.0001$ ).

In the year leading up to the specialist index visit, 34% and 41% of patients who saw a surgeon only, or first, filled any opioid prescription, whereas 50% of patients who saw a pain specialist only, or first, filled any opioid prescription before the specialist index visit ( $P < 0.0001$ ). Average daily MME in the 1 year prior to the first specialist visit among patients with an opioid prescription ranged from 16 mg/day in the surgeon-only cohort to 39 mg/day in the pain-specialist only cohort ( $P < 0.0001$ ). More patients managed only by a pain physician filled an opioid prescription during follow-up (53%) than those managed only by a surgeon (41%) (Appendix Fig. 1). Interestingly, however, the average daily MME among patients managed only by a pain specialist decreased from 48 mg/day for patients treated in 2016 to 15 mg/day in 2019 (Appendix Fig. 2).

### Unadjusted Payments

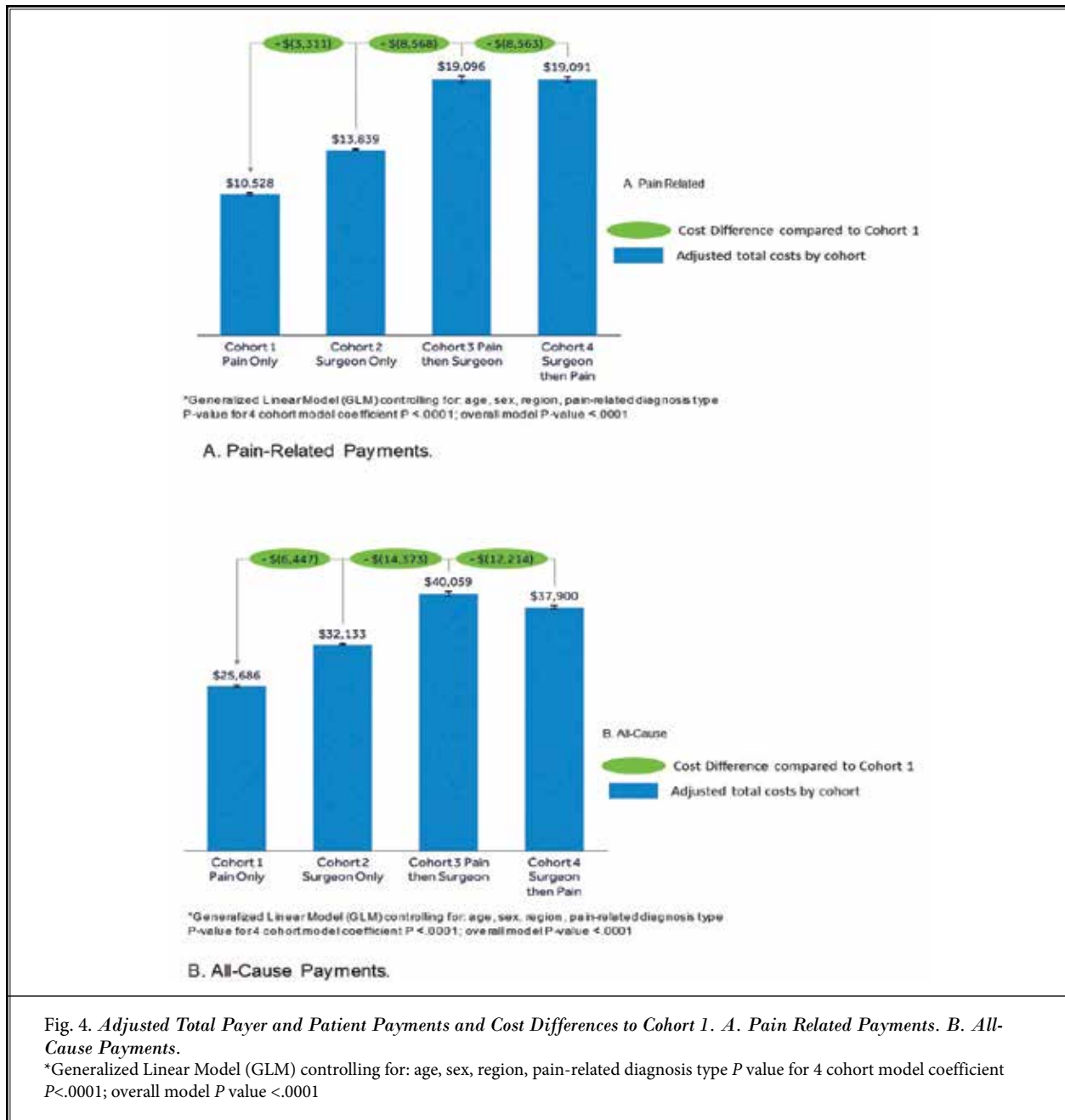
Mean (95% confidence interval) total pain-related payments, including payer and patient unadjusted out-of-pocket payments, were \$11,931 (\$11,666.8 - \$12,195.2) for the pain-specialist only cohort, \$16,518.7 (\$16,371.2 - \$16,666.2) for the surgeon-only cohort, \$25,897.3 (\$25,077.8 - \$26,716.8) for the surgeon-first cohort, and \$25,581.6 (\$24,959.5 - \$26,203.8) for the pain-specialist first cohort ( $P < 0.0001$ ). Pain-related inpatient costs amounted to 27% of total pain-related costs for the pain-specialist only cohort and 59% for surgeon-only managed patients ( $P < 0.0001$ ; Fig. 3a). In sensitivity analyses that collapsed cohorts 1 and 3 ("pain specialist only or first") and 2 and 4 ("surgeon only or first"), unadjusted mean total costs were \$16,671.2 and \$17,581.6 respectively ( $P = 0.526$ ), with 39% of costs driven by inpatient care among "pain specialist only or first" patients and 58% among "surgeon only or first" patients ( $P < 0.0001$ ).

Total mean (95% CI) unadjusted all-cause costs were \$28,334.1 (\$27,903.5 - \$28,764.7) in the pain-specialist only cohort, \$35,581.1 (\$35,366.7 - \$35,795.4) for the surgeon-only cohort, \$46,953.5 (\$45,957.4 - \$47,949.6) for the surgeon-first cohort, and \$50,472 (\$49,524.2 - \$51,419.9) for the pain-specialist first cohort ( $P < 0.001$ ). The highest proportion of all-cause costs for the pain-specialist only cohort was attributed to non-opioid pain prescriptions and the lowest to inpatient costs (Fig. 3b). In sensitivity analyses with collapsed cohorts, the pain specialist only or first cohort had similar unadjusted all-cause costs compared to the surgeon only or first cohort (\$36,021.6 versus \$36,869.9;  $P = 0.0009$ ).



### Adjusted Payments

The independent effect of physician specialist pathway on payments was estimated using GLM regression analyses, controlled for by patient age, gender, geographic region, and specific spine-related pain diagnosis. Mean (95% CI) total adjusted pain-related costs were \$10,528 (\$10,345 - \$10,713) for the pain-specialist only cohort, \$13,839 (\$13,727 - \$13,952) for the surgeon-only cohort, \$19,096 (\$18,646 - \$19,558) for pain-specialist first, and \$19,091 (\$18,706 - \$19,483) for the surgeon-first cohort ( $P < 0.001$ ; Fig. 4a). Sensitiv-



ity analyses with collapsed cohorts showed a statistically significant but marginal cost savings of \$1,064 in total adjusted pain-related costs when patients were treated by a pain specialist only or first instead of a surgeon only or first (\$13,372 vs \$14,436;  $P < 0.001$ ).

GLM-adjusted, all-cause total costs followed a similar pattern. Adjusted mean (95% CI) were \$25,686 (\$25,380 - \$25,996) for the pain-specialist only co-

hort, \$32,133 (\$31,954 - \$32,312) for the surgeon-only, \$40,059 (\$39,411 - \$40,718) for surgeon first, and \$37,900 (\$37,377- \$38,431) for pain specialist first ( $P < 0.001$ ; Fig. 4b). Sensitivity analyses showed a statistically significant all-cause cost savings of \$2,273 when patients were treated by a pain specialist only or first instead of a surgeon only or first (\$30,510 vs \$32,783;  $P < 0.001$ ).



## DISCUSSION

This retrospective analysis of commercially insured patients with chronic spinal pain suggests that in the first year of chronic pain, care provided by a pain specialist alone may save payer and patient costs relative to management by a surgical specialist alone or in combination with a pain specialist. In year one after referral, average adjusted per-patient savings ranged from \$3,311 for pain-related costs to \$6,447 for all-cause medical resource use when comparing patients who saw only one specialist type.

Despite this potential for savings, only 22% of patients meeting the inclusion criteria of chronic, spine-related pain with no neurologic deficit saw a pain specialist during the study period (Fig. 2). Taken together, these findings suggest that referral patterns for pain management represent a potential clinical practice gap to be addressed among primary care physicians.

By referring patients to a pain management specialist as an intermediate step between primary care and surgery—much as a patient would be referred to a cardiologist before seeing a cardiac surgeon—primary care providers could help many patients avoid costly surgical procedures. This is not to say there is no role for surgical intervention, but among patients without immediate, well-defined, neurologic need for surgery, starting with nonsurgical pain management may achieve acceptable pain control while also saving money and freeing up resources for other pressing needs.

This study showed that meaningful savings were associated when patients were managed by a pain specialist instead of a surgeon alone. As might be expected, when comparing total costs among patients who saw a pain physician first, followed by a surgeon, and vice versa, costs were higher than for those who saw only one specialist. These patients may have had more severe pain or greater functional impairment, but that was difficult to test retrospectively.

We observed higher opioid prescription fill rates and dose levels during follow-up among patients who saw a pain specialist compared to those seeing a surgical specialist. However, rates and dose levels were relatively consistent in all cohorts when compared to the one-year prior to the first specialist visit, suggesting that referral itself did not markedly affect opioid utilization.

Notably, when the average daily opioid dose prescribed and filled was summarized by year of index date, a marked decline in average daily MME was observed across all study cohorts (Appendix Fig. 2). The

average daily MME decreased from 48 mg/day to 15 mg/day among patients whose care was managed by a pain specialist alone. This finding may reflect recent practice changes among pain specialists spurred in part by CDC guidelines on opioid prescribing for chronic pain and the US Department of Health and Human Services' congressionally mandated Pain Management Best Practices Inter-Agency Task Force report (15,16).

The volume of spinal surgery is increasing in the US, from a rate of 32.1 surgeries per 100,000 US adults in 2004 to 79.8 per 100,000 in 2015 (17). Total hospital costs increased 177% over the same period, to an average of more than \$50,000 per fusion surgery in 2015 USD (17). However, not all patients experience pain relief and functional improvement following surgery. An analysis of the UK Clinical Practice Research Data-link (CPRD) found that among patients undergoing a variety of lumbar spinal surgeries, 19.4% to 21.6% developed persistent postoperative pain characterized by repeat surgery within 24 months, an outpatient surgical intervention for pain, or at least one pain-related visit to a general practitioner or pain clinic over 2 consecutive quarters in the 24 months following surgery (18). Taken together, these findings support our study's conclusions that alternative management prior to surgical intervention may reduce the economic burden of care.

The number, variety, and cost of proposed treatments for chronic spinal pain have evolved in recent decades, outpacing the growth of the evidence base with which physicians and payers must balance cost utility against medical necessity. Various organizations, including the American Society of Interventional Pain Physicians (ASIPP) and The American College of Occupational and Environmental Medicine (ACOEM), have advocated for different—and in some cases disparate—treatment approaches and clinical pathways for chronic pain management (11,12,19-21). Many of the controversies appear to stem from differences in philosophical and clinical perspectives that could be resolved with a broader evidence base (22,23). The research presented here is intended to help fulfill that need.

## Limitations

This study was subject to limitations inherent to retrospective claims data, including potential miscoding of diagnoses and payment errors. We could not validate physician specialty reported to the payer, given the de-identified nature of the data source. Ideally, we would have limited this study to pain management physicians that performed a minimum number of in-

interventional pain procedures per year to validate their status as a specialist; however, that was not possible given the data source structure.

We also were only able to review claims data as part of this retrospective review. It is possible that if superior pain relief was noted in either group, that would justify an increase in costs. However, pain scores were not available for review. We were also unable to cleanly segregate the referral time period from the cost-assessment time period due to the importance of costs incurred over both periods.

Further, this study is likely not representative of all patients with spine-related pain. Due to limitations in available data, we were unable to control for pain severity or overall medical and socioeconomic complexity, and the population studied here was limited to patients with commercial insurance. We also required continuous health plan enrollment to evaluate all use of healthcare resources, which may have biased the study to a “healthier” population whose pain did not progress to the point of affecting employment status and associated insurance coverage. Therefore, the study assumes a referral decision pathway that may not fully represent the complexity of how such decisions are made in the real world.

Finally, the use of retrospective data-imposed constraints on cohort design and selection. In real-world settings, primary-care physicians make informed guesses about which referral path will offer a given patient the best trade-off between costs and outcomes;

they cannot, however, predict the patient’s future with absolute certainty. Therefore, the results must be viewed through the lens of a descriptive study suggesting that substantial cost savings may be realized based on referral path. In the absence of outcomes data, we would at the very least urge primary care physicians to be purposeful in considering what referral path to recommend for a particular patient rather than treating surgery as the default pathway as our findings suggests is currently the norm.

## CONCLUSIONS

This study demonstrates the potential for cost savings when chronic spine pain is managed by a pain management specialist instead of a surgeon in the first year after developing chronic pain. With chronic pain growing in prevalence, US payers will apply increasing scrutiny to care pathways for managing these patients. Ultimately, the choice regarding pathway should be a decision between the referring physician and the patient, without cost as a primary consideration. However, beginning with a pain specialist may be a cost-effective option both for price-sensitive patients and for payers that need to manage overall healthcare expenditures.

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**Supplemental material available at [www.painphysicianjournal.com](http://www.painphysicianjournal.com)**

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Appendix Table 1. *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	G56.40	Causalgia of unspecified upper limb
	G56.41	Causalgia of right upper limb
	G56.42	Causalgia of left upper limb
	G56.43	Causalgia of bilateral upper limbs
	G56.90	Unspecified mononeuropathy of unspecified upper limb
	G56.91	Unspecified mononeuropathy of right upper limb
	G56.92	Unspecified mononeuropathy of left upper limb
	G57.70	Causalgia of unspecified lower limb
	G57.71	Causalgia of right lower limb
	G57.72	Causalgia of left lower limb
	G57.73	Causalgia of bilateral lower limbs
	G57.90	Unspecified mononeuropathy of unspecified lower limb
	G57.91	Unspecified mononeuropathy of right lower limb
	G57.92	Unspecified mononeuropathy of left lower limb
	G89.0	Central pain syndrome
	G89.29	Other chronic pain
	G89.4	Chronic pain syndrome
	G90.511	Complex regional pain syndrome I of right upper limb
	G90.512	Complex regional pain syndrome I of left upper limb
	G90.513	Complex regional pain syndrome I of upper limb, bilateral
	G90.519	Complex regional pain syndrome I of unspecified upper limb
	G90.521	Complex regional pain syndrome I of right lower limb
	G90.522	Complex regional pain syndrome I of left lower limb
	G90.523	Complex regional pain syndrome I of lower limb, bilateral
	G90.529	Complex regional pain syndrome I of unspecified lower limb
	M43.00	Spondylolysis, site unspecified
	M43.01	Spondylolysis, occipito-atlanto-axial region
	M43.02	Spondylolysis, cervical region
	M43.03	Spondylolysis, cervicothoracic region
	M43.04	Spondylolysis, thoracic region
	M43.05	Spondylolysis, thoracolumbar region
	M43.06	Spondylolysis, lumbar region
	M43.07	Spondylolysis, lumbosacral region
	M43.08	Spondylolysis, sacral and sacrococcygeal region
	M43.09	Spondylolysis, multiple sites in spine
	M43.10	Spondylolisthesis, site unspecified
	M43.11	Spondylolisthesis, occipito-atlanto-axial region
	M43.12	Spondylolisthesis, cervical region
	M43.13	Spondylolisthesis, cervicothoracic region
	M43.14	Spondylolisthesis, thoracic region
	M43.15	Spondylolisthesis, thoracolumbar region
	M43.16	Spondylolisthesis, lumbar region

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M43.17	Spondylolisthesis, lumbosacral region
	M43.18	Spondylolisthesis, sacral and sacrococcygeal region
	M43.19	Spondylolisthesis, multiple sites in spine
	M47.20	Other spondylosis with radiculopathy, site unspecified
	M47.21	Other spondylosis with radiculopathy, occipito-atlanto-axial region
	M47.22	Other spondylosis with radiculopathy, cervical region
	M47.23	Other spondylosis with radiculopathy, cervicothoracic region
	M47.24	Other spondylosis with radiculopathy, thoracic region
	M47.25	Other spondylosis with radiculopathy, thoracolumbar region
	M47.26	Other spondylosis with radiculopathy, lumbar region
	M47.27	Other spondylosis with radiculopathy, lumbosacral region
	M47.28	Other spondylosis with radiculopathy, sacral and sacrococcygeal region
	M47.811	Spondylosis without myelopathy or radiculopathy, occipito-atlanto-axial region
	M47.812	Spondylosis without myelopathy or radiculopathy, cervical region
	M47.813	Spondylosis without myelopathy or radiculopathy, cervicothoracic region
	M47.814	Spondylosis without myelopathy or radiculopathy, thoracic region
	M47.815	Spondylosis without myelopathy or radiculopathy, thoracolumbar region
	M47.816	Spondylosis without myelopathy or radiculopathy, lumbar region
	M47.817	Spondylosis without myelopathy or radiculopathy, lumbosacral region
	M47.818	Spondylosis without myelopathy or radiculopathy, sacral and sacrococcygeal region
	M47.819	Spondylosis without myelopathy or radiculopathy, site unspecified
	M47.891	Other spondylosis, occipito-atlanto-axial region
	M47.892	Other spondylosis, cervical region
	M47.893	Other spondylosis, cervicothoracic region
	M47.894	Other spondylosis, thoracic region
	M47.895	Other spondylosis, thoracolumbar region
	M47.896	Other spondylosis, lumbar region
	M47.897	Other spondylosis, lumbosacral region
	M47.898	Other spondylosis, sacral and sacrococcygeal region
	M47.899	Other spondylosis, site unspecified
	M47.9	Spondylosis, unspecified
	M48.00	Spinal stenosis, site unspecified
	M48.01	Spinal stenosis, occipito-atlanto-axial region
	M48.02	Spinal stenosis, cervical region
	M48.03	Spinal stenosis, cervicothoracic region
	M48.04	Spinal stenosis, thoracic region
	M48.05	Spinal stenosis, thoracolumbar region
	M48.061	Spinal stenosis, lumbar region without neurogenic claudication
	M48.062	Spinal stenosis, lumbar region with neurogenic claudication
	M48.07	Spinal stenosis, lumbosacral region
	M48.08	Spinal stenosis, sacral and sacrococcygeal region
	M48.20	Kissing spine, site unspecified



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M48.21	Kissing spine, occipito-atlanto-axial region
	M48.22	Kissing spine, cervical region
	M48.23	Kissing spine, cervicothoracic region
	M48.24	Kissing spine, thoracic region
	M48.25	Kissing spine, thoracolumbar region
	M48.26	Kissing spine, lumbar region
	M48.27	Kissing spine, lumbosacral region
	M50.10	Cervical disc disorder with radiculopathy, unspecified cervical region
	M50.11	Cervical disc disorder with radiculopathy, high cervical region
	M50.120	Mid-cervical disc disorder, unspecified level
	M50.121	Cervical disc disorder at C4-C5 level with radiculopathy
	M50.122	Cervical disc disorder at C5-C6 level with radiculopathy
	M50.123	Cervical disc disorder at C6-C7 level with radiculopathy
	M50.13	Cervical disc disorder with radiculopathy, cervicothoracic region
	M50.20	Other cervical disc displacement, unspecified cervical region
	M50.21	Other cervical disc displacement, high cervical region
	M50.220	Other cervical disc displacement, mid-cervical region, unspecified level
	M50.221	Other cervical disc displacement at C4-C5 level
	M50.222	Other cervical disc displacement at C5-C6 level
	M50.223	Other cervical disc displacement at C6-C7 level
	M50.23	Other cervical disc displacement, cervicothoracic region
	M50.30	Other cervical disc degeneration, unspecified cervical region
	M50.31	Other cervical disc degeneration, high cervical region
	M50.320	Other cervical disc degeneration, mid-cervical region, unspecified level
	M50.321	Other cervical disc degeneration at C4-C5 level
	M50.322	Other cervical disc degeneration at C5-C6 level
	M50.323	Other cervical disc degeneration at C6-C7 level
	M50.33	Other cervical disc degeneration, cervicothoracic region
	M50.80	Other cervical disc disorders, unspecified cervical region
	M50.81	Other cervical disc disorders, high cervical region
	M50.820	Other cervical disc disorders, mid-cervical region, unspecified level
	M50.821	Other cervical disc disorders at C4-C5 level
	M50.822	Other cervical disc disorders at C5-C6 level
	M50.823	Other cervical disc disorders at C6-C7 level
	M50.83	Other cervical disc disorders, cervicothoracic region
	M50.90	Cervical disc disorder, unspecified, unspecified cervical region
	M50.91	Cervical disc disorder, unspecified, high cervical region
	M50.920	Unspecified cervical disc disorder, mid-cervical region, unspecified level
	M50.921	Unspecified cervical disc disorder at C4-C5 level
	M50.922	Unspecified cervical disc disorder at C5-C6 level
	M50.923	Unspecified cervical disc disorder at C6-C7 level
	M50.93	Cervical disc disorder, unspecified, cervicothoracic region
	M51.14	Intervertebral disc disorders with radiculopathy, thoracic region

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M51.15	Intervertebral disc disorders with radiculopathy, thoracolumbar region
	M51.16	Intervertebral disc disorders with radiculopathy, lumbar region
	M51.17	Intervertebral disc disorders with radiculopathy, lumbosacral region
	M51.24	Other intervertebral disc displacement, thoracic region
	M51.25	Other intervertebral disc displacement, thoracolumbar region
	M51.26	Other intervertebral disc displacement, lumbar region
	M51.27	Other intervertebral disc displacement, lumbosacral region
	M51.34	Other intervertebral disc degeneration, thoracic region
	M51.35	Other intervertebral disc degeneration, thoracolumbar region
	M51.36	Other intervertebral disc degeneration, lumbar region
	M51.37	Other intervertebral disc degeneration, lumbosacral region
	M51.44	Schmorl's nodes, thoracic region
	M51.45	Schmorl's nodes, thoracolumbar region
	M51.46	Schmorl's nodes, lumbar region
	M51.47	Schmorl's nodes, lumbosacral region
	M51.84	Other intervertebral disc disorders, thoracic region
	M51.85	Other intervertebral disc disorders, thoracolumbar region
	M51.86	Other intervertebral disc disorders, lumbar region
	M51.87	Other intervertebral disc disorders, lumbosacral region
	M51.9	Unspecified thoracic, thoracolumbar, and lumbosacral intervertebral disc disorder
	M53.1	Cervicobrachial syndrome
	M53.3	Sacrococcygeal disorders, not elsewhere classified
	M54.10	Radiculopathy, site unspecified
	M54.11	Radiculopathy, occipito-atlanto-axial region
	M54.12	Radiculopathy, cervical region
	M54.13	Radiculopathy, cervicothoracic region
	M54.14	Radiculopathy, thoracic region
	M54.15	Radiculopathy, thoracolumbar region
	M54.16	Radiculopathy, lumbar region
	M54.17	Radiculopathy, lumbosacral region
	M54.18	Radiculopathy, sacral and sacrococcygeal region
	M54.2	Cervicalgia
	M54.30	Sciatica, unspecified side
	M54.31	Sciatica, right side
	M54.32	Sciatica, left side
	M54.40	Lumbago with sciatica, unspecified side
	M54.41	Lumbago with sciatica, right side
	M54.42	Lumbago with sciatica, left side
	M54.5	Low back pain
	M54.6	Pain in thoracic spine
	M54.89	Other dorsalgia
	M54.9	Dorsalgia, unspecified

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M96.1	Postlaminectomy syndrome, not elsewhere classified
	M96.1	Postlaminectomy syndrome, not elsewhere classified
Inclusion/ Exclusion	Code	Description (all pain symptoms and conditions)
	G54.2	Cervical root disorders, not elsewhere classified
	G56.40	Causalgia of unspecified upper limb
	G56.41	Causalgia of right upper limb
	G56.42	Causalgia of left upper limb
	G56.43	Causalgia of bilateral upper limbs
	G56.80	Other specified mononeuropathies of unspecified upper limb
	G56.81	Other specified mononeuropathies of right upper limb
	G56.82	Other specified mononeuropathies of left upper limb
	G56.83	Other specified mononeuropathies of bilateral upper limbs
	G56.90	Unspecified mononeuropathy of unspecified upper limb
	G56.91	Unspecified mononeuropathy of right upper limb
	G56.92	Unspecified mononeuropathy of left upper limb
	G56.93	Unspecified mononeuropathy of bilateral upper limbs
	G57.70	Causalgia of unspecified lower limb
	G57.71	Causalgia of right lower limb
	G57.72	Causalgia of left lower limb
	G57.73	Causalgia of bilateral lower limbs
	G57.90	Unspecified mononeuropathy of unspecified lower limb
	G57.91	Unspecified mononeuropathy of right lower limb
	G57.92	Unspecified mononeuropathy of left lower limb
	G57.93	Unspecified mononeuropathy of bilateral lower limbs
	G89.0	Central pain syndrome
	G89.21	Chronic pain due to trauma
	G89.29	Other chronic pain
	G89.4	Chronic pain syndrome
	G90.511	Complex regional pain syndrome I of right upper limb
	G90.512	Complex regional pain syndrome I of left upper limb
	G90.513	Complex regional pain syndrome I of upper limb, bilateral
	G90.519	Complex regional pain syndrome I of unspecified upper limb
	G90.521	Complex regional pain syndrome I of right lower limb
	G90.522	Complex regional pain syndrome I of left lower limb
	G90.523	Complex regional pain syndrome I of lower limb, bilateral
	G90.529	Complex regional pain syndrome I of unspecified lower limb
	M25.511	Pain in right shoulder
	M25.512	Pain in left shoulder
	M25.519	Pain in unspecified shoulder
	M25.521	Pain in right elbow
	M25.522	Pain in left elbow
	M25.529	Pain in unspecified elbow

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M25.531	Pain in right wrist
	M25.532	Pain in left wrist
	M25.539	Pain in unspecified wrist
	M25.541	Pain in joints of right hand
	M25.542	Pain in joints of left hand
	M25.549	Pain in joints of unspecified hand
	M43.00	Spondylolysis, site unspecified
	M43.01	Spondylolysis, occipito-atlanto-axial region
	M43.02	Spondylolysis, cervical region
	M43.03	Spondylolysis, cervicothoracic region
	M43.04	Spondylolysis, thoracic region
	M43.05	Spondylolysis, thoracolumbar region
	M43.06	Spondylolysis, lumbar region
	M43.07	Spondylolysis, lumbosacral region
	M43.08	Spondylolysis, sacral and sacrococcygeal region
	M43.09	Spondylolysis, multiple sites in spine
	M43.10	Spondylolisthesis, site unspecified
	M43.11	Spondylolisthesis, occipito-atlanto-axial region
	M43.12	Spondylolisthesis, cervical region
	M43.13	Spondylolisthesis, cervicothoracic region
	M43.14	Spondylolisthesis, thoracic region
	M43.15	Spondylolisthesis, thoracolumbar region
	M43.16	Spondylolisthesis, lumbar region
	M43.17	Spondylolisthesis, lumbosacral region
	M43.18	Spondylolisthesis, sacral and sacrococcygeal region
	M43.19	Spondylolisthesis, multiple sites in spine
	M45.1	Ankylosing spondylitis of occipito-atlanto-axial region
	M45.2	Ankylosing spondylitis of cervical region
	M45.3	Ankylosing spondylitis of cervicothoracic region
	M46.51	Other infective spondylopathies, occipito-atlanto-axial region
	M46.52	Other infective spondylopathies, cervical region
	M46.53	Other infective spondylopathies, cervicothoracic region
	M46.81	Other specified inflammatory spondylopathies, occipito-atlanto-axial region
	M46.82	Other specified inflammatory spondylopathies, cervical region
	M46.83	Other specified inflammatory spondylopathies, cervicothoracic region
	M47.011	Anterior spinal artery compression syndromes, occipito-atlanto-axial region
	M47.20	Other spondylosis with radiculopathy, site unspecified
	M47.21	Other spondylosis with radiculopathy, occipito-atlanto-axial region
	M47.22	Other spondylosis with radiculopathy, cervical region
	M47.23	Other spondylosis with radiculopathy, cervicothoracic region
	M47.24	Other spondylosis with radiculopathy, thoracic region
	M47.25	Other spondylosis with radiculopathy, thoracolumbar region
	M47.26	Other spondylosis with radiculopathy, lumbar region

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M47.27	Other spondylosis with radiculopathy, lumbosacral region
	M47.28	Other spondylosis with radiculopathy, sacral and sacrococcygeal region
	M47.811	Spondylosis without myelopathy or radiculopathy, occipito-atlanto-axial region
	M47.812	Spondylosis without myelopathy or radiculopathy, cervical region
	M47.813	Spondylosis without myelopathy or radiculopathy, cervicothoracic region
	M47.814	Spondylosis without myelopathy or radiculopathy, thoracic region
	M47.815	Spondylosis without myelopathy or radiculopathy, thoracolumbar region
	M47.816	Spondylosis without myelopathy or radiculopathy, lumbar region
	M47.817	Spondylosis without myelopathy or radiculopathy, lumbosacral region
	M47.818	Spondylosis without myelopathy or radiculopathy, sacral and sacrococcygeal region
	M47.819	Spondylosis without myelopathy or radiculopathy, site unspecified
	M47.891	Other spondylosis, occipito-atlanto-axial region
	M47.892	Other spondylosis, cervical region
	M47.893	Other spondylosis, cervicothoracic region
	M47.894	Other spondylosis, thoracic region
	M47.895	Other spondylosis, thoracolumbar region
	M47.896	Other spondylosis, lumbar region
	M47.897	Other spondylosis, lumbosacral region
	M47.898	Other spondylosis, sacral and sacrococcygeal region
	M47.899	Other spondylosis, site unspecified
	M47.9	Spondylosis, unspecified
	M48.00	Spinal stenosis, site unspecified
	M48.01	Spinal stenosis, occipito-atlanto-axial region
	M48.02	Spinal stenosis, cervical region
	M48.03	Spinal stenosis, cervicothoracic region
	M48.04	Spinal stenosis, thoracic region
	M48.05	Spinal stenosis, thoracolumbar region
	M48.061	Spinal stenosis, lumbar region without neurogenic claudication
	M48.062	Spinal stenosis, lumbar region with neurogenic claudication
	M48.07	Spinal stenosis, lumbosacral region
	M48.08	Spinal stenosis, sacral and sacrococcygeal region
	M48.20	Kissing spine, site unspecified
	M48.21	Kissing spine, occipito-atlanto-axial region
	M48.22	Kissing spine, cervical region
	M48.23	Kissing spine, cervicothoracic region
	M48.24	Kissing spine, thoracic region
	M48.25	Kissing spine, thoracolumbar region
	M48.26	Kissing spine, lumbar region
	M48.27	Kissing spine, lumbosacral region
	M48.30	Traumatic spondylopathy, site unspecified
	M48.31	Traumatic spondylopathy, occipito-atlanto-axial region
	M48.32	Traumatic spondylopathy, cervical region
	M48.33	Traumatic spondylopathy, cervicothoracic region

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M48.34	Traumatic spondylopathy, thoracic region
	M48.35	Traumatic spondylopathy, thoracolumbar region
	M48.36	Traumatic spondylopathy, lumbar region
	M48.37	Traumatic spondylopathy, lumbosacral region
	M48.38	Traumatic spondylopathy, sacral and sacrococcygeal region
	M48.40XA	Fatigue fracture of vertebra, site unspecified, initial encounter for fracture
	M48.40XD	Fatigue fracture of vertebra, site unspecified, subsequent encounter for fracture with routine healing
	M48.40XG	Fatigue fracture of vertebra, site unspecified, subsequent encounter for fracture with delayed healing
	M48.40XS	Fatigue fracture of vertebra, site unspecified, sequela of fracture
	M48.41XA	Fatigue fracture of vertebra, occipito-atlanto-axial region, initial encounter for fracture
	M48.41XD	Fatigue fracture of vertebra, occipito-atlanto-axial region, subsequent encounter for fracture with routine healing
	M48.41XG	Fatigue fracture of vertebra, occipito-atlanto-axial region, subsequent encounter for fracture with delayed healing
	M48.41XS	Fatigue fracture of vertebra, occipito-atlanto-axial region, sequela of fracture
	M48.42XA	Fatigue fracture of vertebra, cervical region, initial encounter for fracture
	M48.42XD	Fatigue fracture of vertebra, cervical region, subsequent encounter for fracture with routine healing
	M48.42XG	Fatigue fracture of vertebra, cervical region, subsequent encounter for fracture with delayed healing
	M48.42XS	Fatigue fracture of vertebra, cervical region, sequela of fracture
	M48.43XA	Fatigue fracture of vertebra, cervicothoracic region, initial encounter for fracture
	M48.43XD	Fatigue fracture of vertebra, cervicothoracic region, subsequent encounter for fracture with routine healing
	M48.43XG	Fatigue fracture of vertebra, cervicothoracic region, subsequent encounter for fracture with delayed healing
	M48.43XS	Fatigue fracture of vertebra, cervicothoracic region, sequela of fracture
	M48.44XA	Fatigue fracture of vertebra, thoracic region, initial encounter for fracture
	M48.44XD	Fatigue fracture of vertebra, thoracic region, subsequent encounter for fracture with routine healing
	M48.44XG	Fatigue fracture of vertebra, thoracic region, subsequent encounter for fracture with delayed healing
	M48.44XS	Fatigue fracture of vertebra, thoracic region, sequela of fracture
	M48.45XA	Fatigue fracture of vertebra, thoracolumbar region, initial encounter for fracture
	M48.45XD	Fatigue fracture of vertebra, thoracolumbar region, subsequent encounter for fracture with routine healing
	M48.45XG	Fatigue fracture of vertebra, thoracolumbar region, subsequent encounter for fracture with delayed healing
	M48.45XS	Fatigue fracture of vertebra, thoracolumbar region, sequela of fracture
	M48.46XA	Fatigue fracture of vertebra, lumbar region, initial encounter for fracture
	M48.46XD	Fatigue fracture of vertebra, lumbar region, subsequent encounter for fracture with routine healing
	M48.46XG	Fatigue fracture of vertebra, lumbar region, subsequent encounter for fracture with delayed healing
	M48.46XS	Fatigue fracture of vertebra, lumbar region, sequela of fracture
	M48.47XA	Fatigue fracture of vertebra, lumbosacral region, initial encounter for fracture
	M48.47XD	Fatigue fracture of vertebra, lumbosacral region, subsequent encounter for fracture with routine healing
	M48.47XG	Fatigue fracture of vertebra, lumbosacral region, subsequent encounter for fracture with delayed healing
	M48.47XS	Fatigue fracture of vertebra, lumbosacral region, sequela of fracture
	M48.48XA	Fatigue fracture of vertebra, sacral and sacrococcygeal region, initial encounter for fracture
	M48.48XD	Fatigue fracture of vertebra, sacral and sacrococcygeal region, subsequent encounter for fracture with routine healing
	M48.48XG	Fatigue fracture of vertebra, sacral and sacrococcygeal region, subsequent encounter for fracture with delayed healing
	M48.48XS	Fatigue fracture of vertebra, sacral and sacrococcygeal region, sequela of fracture
	M48.50XA	Collapsed vertebra, not elsewhere classified, site unspecified, initial encounter for fracture
	M48.50XD	Collapsed vertebra, not elsewhere classified, site unspecified, subsequent encounter for fracture with routine healing



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M48.50XG	Collapsed vertebra, not elsewhere classified, site unspecified, subsequent encounter for fracture with delayed healing
	M48.50XS	Collapsed vertebra, not elsewhere classified, site unspecified, sequela of fracture
	M48.51XA	Collapsed vertebra, not elsewhere classified, occipito-atlanto-axial region, initial encounter for fracture
	M48.51XD	Collapsed vertebra, not elsewhere classified, occipito-atlanto-axial region, subsequent encounter for fracture with routine healing
	M48.51XG	Collapsed vertebra, not elsewhere classified, occipito-atlanto-axial region, subsequent encounter for fracture with delayed healing
	M48.51XS	Collapsed vertebra, not elsewhere classified, occipito-atlanto-axial region, sequela of fracture
	M48.52XA	Collapsed vertebra, not elsewhere classified, cervical region, initial encounter for fracture
	M48.52XD	Collapsed vertebra, not elsewhere classified, cervical region, subsequent encounter for fracture with routine healing
	M48.52XG	Collapsed vertebra, not elsewhere classified, cervical region, subsequent encounter for fracture with delayed healing
	M48.52XS	Collapsed vertebra, not elsewhere classified, cervical region, sequela of fracture
	M48.53XA	Collapsed vertebra, not elsewhere classified, cervicothoracic region, initial encounter for fracture
	M48.53XD	Collapsed vertebra, not elsewhere classified, cervicothoracic region, subsequent encounter for fracture with routine healing
	M48.53XG	Collapsed vertebra, not elsewhere classified, cervicothoracic region, subsequent encounter for fracture with delayed healing
	M48.53XS	Collapsed vertebra, not elsewhere classified, cervicothoracic region, sequela of fracture
	M48.54XA	Collapsed vertebra, not elsewhere classified, thoracic region, initial encounter for fracture
	M48.54XD	Collapsed vertebra, not elsewhere classified, thoracic region, subsequent encounter for fracture with routine healing
	M48.54XG	Collapsed vertebra, not elsewhere classified, thoracic region, subsequent encounter for fracture with delayed healing
	M48.54XS	Collapsed vertebra, not elsewhere classified, thoracic region, sequela of fracture
	M48.55XA	Collapsed vertebra, not elsewhere classified, thoracolumbar region, initial encounter for fracture
	M48.55XD	Collapsed vertebra, not elsewhere classified, thoracolumbar region, subsequent encounter for fracture with routine healing
	M48.55XG	Collapsed vertebra, not elsewhere classified, thoracolumbar region, subsequent encounter for fracture with delayed healing
	M48.55XS	Collapsed vertebra, not elsewhere classified, thoracolumbar region, sequela of fracture
	M48.56XA	Collapsed vertebra, not elsewhere classified, lumbar region, initial encounter for fracture
	M48.56XD	Collapsed vertebra, not elsewhere classified, lumbar region, subsequent encounter for fracture with routine healing
	M48.56XG	Collapsed vertebra, not elsewhere classified, lumbar region, subsequent encounter for fracture with delayed healing
	M48.56XS	Collapsed vertebra, not elsewhere classified, lumbar region, sequela of fracture
	M48.57XA	Collapsed vertebra, not elsewhere classified, lumbosacral region, initial encounter for fracture
	M48.57XD	Collapsed vertebra, not elsewhere classified, lumbosacral region, subsequent encounter for fracture with routine healing
	M48.57XG	Collapsed vertebra, not elsewhere classified, lumbosacral region, subsequent encounter for fracture with delayed healing
	M48.57XS	Collapsed vertebra, not elsewhere classified, lumbosacral region, sequela of fracture
	M48.58XA	Collapsed vertebra, not elsewhere classified, sacral and sacrococcygeal region, initial encounter for fracture
	M48.58XD	Collapsed vertebra, not elsewhere classified, sacral and sacrococcygeal region, subsequent encounter for fracture with routine healing
	M48.58XG	Collapsed vertebra, not elsewhere classified, sacral and sacrococcygeal region, subsequent encounter for fracture with delayed healing
	M48.58XS	Collapsed vertebra, not elsewhere classified, sacral and sacrococcygeal region, sequela of fracture
	M50.10	Cervical disc disorder with radiculopathy, unspecified cervical region
	M50.11	Cervical disc disorder with radiculopathy, high cervical region

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M50.120	Mid-cervical disc disorder, unspecified level
	M50.121	Cervical disc disorder at C4-C5 level with radiculopathy
	M50.122	Cervical disc disorder at C5-C6 level with radiculopathy
	M50.123	Cervical disc disorder at C6-C7 level with radiculopathy
	M50.13	Cervical disc disorder with radiculopathy, cervicothoracic region
	M50.20	Other cervical disc displacement, unspecified cervical region
	M50.21	Other cervical disc displacement, high cervical region
	M50.220	Other cervical disc displacement, mid-cervical region, unspecified level
	M50.221	Other cervical disc displacement at C4-C5 level
	M50.222	Other cervical disc displacement at C5-C6 level
	M50.223	Other cervical disc displacement at C6-C7 level
	M50.23	Other cervical disc displacement, cervicothoracic region
	M50.30	Other cervical disc degeneration, unspecified cervical region
	M50.31	Other cervical disc degeneration, high cervical region
	M50.320	Other cervical disc degeneration, mid-cervical region, unspecified level
	M50.321	Other cervical disc degeneration at C4-C5 level
	M50.322	Other cervical disc degeneration at C5-C6 level
	M50.323	Other cervical disc degeneration at C6-C7 level
	M50.33	Other cervical disc degeneration, cervicothoracic region
	M50.80	Other cervical disc disorders, unspecified cervical region
	M50.81	Other cervical disc disorders, high cervical region
	M50.820	Other cervical disc disorders, mid-cervical region, unspecified level
	M50.821	Other cervical disc disorders at C4-C5 level
	M50.822	Other cervical disc disorders at C5-C6 level
	M50.823	Other cervical disc disorders at C6-C7 level
	M50.83	Other cervical disc disorders, cervicothoracic region
	M50.90	Cervical disc disorder, unspecified, unspecified cervical region
	M50.91	Cervical disc disorder, unspecified, high cervical region
	M50.920	Unspecified cervical disc disorder, mid-cervical region, unspecified level
	M50.921	Unspecified cervical disc disorder at C4-C5 level
	M50.922	Unspecified cervical disc disorder at C5-C6 level
	M50.923	Unspecified cervical disc disorder at C6-C7 level
	M50.93	Cervical disc disorder, unspecified, cervicothoracic region
	M51.14	Intervertebral disc disorders with radiculopathy, thoracic region
	M51.15	Intervertebral disc disorders with radiculopathy, thoracolumbar region
	M51.16	Intervertebral disc disorders with radiculopathy, lumbar region
	M51.17	Intervertebral disc disorders with radiculopathy, lumbosacral region
	M51.24	Other intervertebral disc displacement, thoracic region
	M51.25	Other intervertebral disc displacement, thoracolumbar region
	M51.26	Other intervertebral disc displacement, lumbar region
	M51.27	Other intervertebral disc displacement, lumbosacral region
	M51.34	Other intervertebral disc degeneration, thoracic region
	M51.35	Other intervertebral disc degeneration, thoracolumbar region

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M51.36	Other intervertebral disc degeneration, lumbar region
	M51.37	Other intervertebral disc degeneration, lumbosacral region
	M51.44	Schmorl's nodes, thoracic region
	M51.45	Schmorl's nodes, thoracolumbar region
	M51.46	Schmorl's nodes, lumbar region
	M51.47	Schmorl's nodes, lumbosacral region
	M51.84	Other intervertebral disc disorders, thoracic region
	M51.85	Other intervertebral disc disorders, thoracolumbar region
	M51.86	Other intervertebral disc disorders, lumbar region
	M51.87	Other intervertebral disc disorders, lumbosacral region
	M51.9	Unspecified thoracic, thoracolumbar, and lumbosacral intervertebral disc disorder
	M53.1	Cervicobrachial syndrome
	M53.3	Sacrococcygeal disorders, not elsewhere classified
	M54.10	Radiculopathy, site unspecified
	M54.11	Radiculopathy, occipito-atlanto-axial region
	M54.12	Radiculopathy, cervical region
	M54.13	Radiculopathy, cervicothoracic region
	M54.14	Radiculopathy, thoracic region
	M54.15	Radiculopathy, thoracolumbar region
	M54.16	Radiculopathy, lumbar region
	M54.17	Radiculopathy, lumbosacral region
	M54.18	Radiculopathy, sacral and sacrococcygeal region
	M54.2	Cervicalgia
	M54.30	Sciatica, unspecified side
	M54.31	Sciatica, right side
	M54.32	Sciatica, left side
	M54.40	Lumbago with sciatica, unspecified side
	M54.41	Lumbago with sciatica, right side
	M54.42	Lumbago with sciatica, left side
	M54.5	Low back pain
	M54.6	Pain in thoracic spine
	M54.89	Other dorsalgia
	M54.9	Dorsalgia, unspecified
	M79.601	Pain in right arm
	M79.602	Pain in left arm
	M79.603	Pain in arm, unspecified
	M80.08XA	Age-related osteoporosis with current pathological fracture, vertebra(e), initial encounter for fracture
	M80.08XD	Age-related osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with routine healing
	M80.08XG	Age-related osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with delayed healing
	M80.08XK	Age-related osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with nonunion

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	M80.08XP	Age-related osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with malunion
	M80.08XS	Age-related osteoporosis with current pathological fracture, vertebra(e), sequela
	M80.88XA	Other osteoporosis with current pathological fracture, vertebra(e), initial encounter for fracture
	M80.88XD	Other osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with routine healing
	M80.88XG	Other osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with delayed healing
	M80.88XK	Other osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with nonunion
	M80.88XP	Other osteoporosis with current pathological fracture, vertebra(e), subsequent encounter for fracture with malunion
	M80.88XS	Other osteoporosis with current pathological fracture, vertebra(e), sequela
	M84.68XA	Pathological fracture in other disease, other site, initial encounter for fracture
	M84.68XD	Pathological fracture in other disease, other site, subsequent encounter for fracture with routine healing
	M84.68XG	Pathological fracture in other disease, other site, subsequent encounter for fracture with delayed healing
	M84.68XK	Pathological fracture in other disease, other site, subsequent encounter for fracture with nonunion
	M84.68XP	Pathological fracture in other disease, other site, subsequent encounter for fracture with malunion
	M84.68XS	Pathological fracture in other disease, other site, sequela
	M96.1	Postlaminectomy syndrome, not elsewhere classified
	S12.000A	Unspecified displaced fracture of first cervical vertebra, initial encounter for closed fracture
	S12.000B	Unspecified displaced fracture of first cervical vertebra, initial encounter for open fracture
	S12.000D	Unspecified displaced fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.000G	Unspecified displaced fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.000K	Unspecified displaced fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.000S	Unspecified displaced fracture of first cervical vertebra, sequela
	S12.001A	Unspecified nondisplaced fracture of first cervical vertebra, initial encounter for closed fracture
	S12.001B	Unspecified nondisplaced fracture of first cervical vertebra, initial encounter for open fracture
	S12.001D	Unspecified nondisplaced fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.001G	Unspecified nondisplaced fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.001K	Unspecified nondisplaced fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.001S	Unspecified nondisplaced fracture of first cervical vertebra, sequela
	S12.01XA	Stable burst fracture of first cervical vertebra, initial encounter for closed fracture
	S12.01XB	Stable burst fracture of first cervical vertebra, initial encounter for open fracture
	S12.01XD	Stable burst fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.01XG	Stable burst fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.01XK	Stable burst fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.01XS	Stable burst fracture of first cervical vertebra, sequela
	S12.02XA	Unstable burst fracture of first cervical vertebra, initial encounter for closed fracture
	S12.02XB	Unstable burst fracture of first cervical vertebra, initial encounter for open fracture
	S12.02XD	Unstable burst fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.02XG	Unstable burst fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.02XK	Unstable burst fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.02XS	Unstable burst fracture of first cervical vertebra, sequela
	S12.030A	Displaced posterior arch fracture of first cervical vertebra, initial encounter for closed fracture
	S12.030B	Displaced posterior arch fracture of first cervical vertebra, initial encounter for open fracture

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.030D	Displaced posterior arch fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.030G	Displaced posterior arch fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.030K	Displaced posterior arch fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.030S	Displaced posterior arch fracture of first cervical vertebra, sequela
	S12.031A	Nondisplaced posterior arch fracture of first cervical vertebra, initial encounter for closed fracture
	S12.031B	Nondisplaced posterior arch fracture of first cervical vertebra, initial encounter for open fracture
	S12.031D	Nondisplaced posterior arch fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.031G	Nondisplaced posterior arch fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.031K	Nondisplaced posterior arch fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.031S	Nondisplaced posterior arch fracture of first cervical vertebra, sequela
	S12.040A	Displaced lateral mass fracture of first cervical vertebra, initial encounter for closed fracture
	S12.040B	Displaced lateral mass fracture of first cervical vertebra, initial encounter for open fracture
	S12.040D	Displaced lateral mass fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.040G	Displaced lateral mass fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.040K	Displaced lateral mass fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.040S	Displaced lateral mass fracture of first cervical vertebra, sequela
	S12.041A	Nondisplaced lateral mass fracture of first cervical vertebra, initial encounter for closed fracture
	S12.041B	Nondisplaced lateral mass fracture of first cervical vertebra, initial encounter for open fracture
	S12.041D	Nondisplaced lateral mass fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.041G	Nondisplaced lateral mass fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.041K	Nondisplaced lateral mass fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.041S	Nondisplaced lateral mass fracture of first cervical vertebra, sequela
	S12.090A	Other displaced fracture of first cervical vertebra, initial encounter for closed fracture
	S12.090B	Other displaced fracture of first cervical vertebra, initial encounter for open fracture
	S12.090D	Other displaced fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.090G	Other displaced fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.090K	Other displaced fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.090S	Other displaced fracture of first cervical vertebra, sequela
	S12.091A	Other nondisplaced fracture of first cervical vertebra, initial encounter for closed fracture
	S12.091B	Other nondisplaced fracture of first cervical vertebra, initial encounter for open fracture
	S12.091D	Other nondisplaced fracture of first cervical vertebra, subsequent encounter for fracture with routine healing
	S12.091G	Other nondisplaced fracture of first cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.091K	Other nondisplaced fracture of first cervical vertebra, subsequent encounter for fracture with nonunion
	S12.091S	Other nondisplaced fracture of first cervical vertebra, sequela
	S12.100A	Unspecified displaced fracture of second cervical vertebra, initial encounter for closed fracture
	S12.100B	Unspecified displaced fracture of second cervical vertebra, initial encounter for open fracture
	S12.100D	Unspecified displaced fracture of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.100G	Unspecified displaced fracture of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.100K	Unspecified displaced fracture of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.100S	Unspecified displaced fracture of second cervical vertebra, sequela
	S12.101A	Unspecified nondisplaced fracture of second cervical vertebra, initial encounter for closed fracture
	S12.101B	Unspecified nondisplaced fracture of second cervical vertebra, initial encounter for open fracture
	S12.101D	Unspecified nondisplaced fracture of second cervical vertebra, subsequent encounter for fracture with routine healing

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.101G	Unspecified nondisplaced fracture of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.101K	Unspecified nondisplaced fracture of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.101S	Unspecified nondisplaced fracture of second cervical vertebra, sequela
	S12.110A	Anterior displaced Type II dens fracture, initial encounter for closed fracture
	S12.110B	Anterior displaced Type II dens fracture, initial encounter for open fracture
	S12.110D	Anterior displaced Type II dens fracture, subsequent encounter for fracture with routine healing
	S12.110G	Anterior displaced Type II dens fracture, subsequent encounter for fracture with delayed healing
	S12.110K	Anterior displaced Type II dens fracture, subsequent encounter for fracture with nonunion
	S12.110S	Anterior displaced Type II dens fracture, sequela
	S12.111A	Posterior displaced Type II dens fracture, initial encounter for closed fracture
	S12.111B	Posterior displaced Type II dens fracture, initial encounter for open fracture
	S12.111D	Posterior displaced Type II dens fracture, subsequent encounter for fracture with routine healing
	S12.111G	Posterior displaced Type II dens fracture, subsequent encounter for fracture with delayed healing
	S12.111K	Posterior displaced Type II dens fracture, subsequent encounter for fracture with nonunion
	S12.111S	Posterior displaced Type II dens fracture, sequela
	S12.112A	Nondisplaced Type II dens fracture, initial encounter for closed fracture
	S12.112B	Nondisplaced Type II dens fracture, initial encounter for open fracture
	S12.112D	Nondisplaced Type II dens fracture, subsequent encounter for fracture with routine healing
	S12.112G	Nondisplaced Type II dens fracture, subsequent encounter for fracture with delayed healing
	S12.112K	Nondisplaced Type II dens fracture, subsequent encounter for fracture with nonunion
	S12.112S	Nondisplaced Type II dens fracture, sequela
	S12.120A	Other displaced dens fracture, initial encounter for closed fracture
	S12.120B	Other displaced dens fracture, initial encounter for open fracture
	S12.120D	Other displaced dens fracture, subsequent encounter for fracture with routine healing
	S12.120G	Other displaced dens fracture, subsequent encounter for fracture with delayed healing
	S12.120K	Other displaced dens fracture, subsequent encounter for fracture with nonunion
	S12.120S	Other displaced dens fracture, sequela
	S12.121A	Other nondisplaced dens fracture, initial encounter for closed fracture
	S12.121B	Other nondisplaced dens fracture, initial encounter for open fracture
	S12.121D	Other nondisplaced dens fracture, subsequent encounter for fracture with routine healing
	S12.121G	Other nondisplaced dens fracture, subsequent encounter for fracture with delayed healing
	S12.121K	Other nondisplaced dens fracture, subsequent encounter for fracture with nonunion
	S12.121S	Other nondisplaced dens fracture, sequela
	S12.130A	Unspecified traumatic displaced spondylolisthesis of second cervical vertebra, initial encounter for closed fracture
	S12.130B	Unspecified traumatic displaced spondylolisthesis of second cervical vertebra, initial encounter for open fracture
	S12.130D	Unspecified traumatic displaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.130G	Unspecified traumatic displaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.130K	Unspecified traumatic displaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.130S	Unspecified traumatic displaced spondylolisthesis of second cervical vertebra, sequela
	S12.131A	Unspecified traumatic nondisplaced spondylolisthesis of second cervical vertebra, initial encounter for closed fracture
	S12.131B	Unspecified traumatic nondisplaced spondylolisthesis of second cervical vertebra, initial encounter for open fracture



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.131D	Unspecified traumatic nondisplaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.131G	Unspecified traumatic nondisplaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.131K	Unspecified traumatic nondisplaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.131S	Unspecified traumatic nondisplaced spondylolisthesis of second cervical vertebra, sequela
	S12.14XA	Type III traumatic spondylolisthesis of second cervical vertebra, initial encounter for closed fracture
	S12.14XB	Type III traumatic spondylolisthesis of second cervical vertebra, initial encounter for open fracture
	S12.14XD	Type III traumatic spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.14XG	Type III traumatic spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.14XK	Type III traumatic spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.14XS	Type III traumatic spondylolisthesis of second cervical vertebra, sequela
	S12.150A	Other traumatic displaced spondylolisthesis of second cervical vertebra, initial encounter for closed fracture
	S12.150B	Other traumatic displaced spondylolisthesis of second cervical vertebra, initial encounter for open fracture
	S12.150D	Other traumatic displaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.150G	Other traumatic displaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.150K	Other traumatic displaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.150S	Other traumatic displaced spondylolisthesis of second cervical vertebra, sequela
	S12.151A	Other traumatic nondisplaced spondylolisthesis of second cervical vertebra, initial encounter for closed fracture
	S12.151B	Other traumatic nondisplaced spondylolisthesis of second cervical vertebra, initial encounter for open fracture
	S12.151D	Other traumatic nondisplaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.151G	Other traumatic nondisplaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.151K	Other traumatic nondisplaced spondylolisthesis of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.151S	Other traumatic nondisplaced spondylolisthesis of second cervical vertebra, sequela
	S12.190A	Other displaced fracture of second cervical vertebra, initial encounter for closed fracture
	S12.190B	Other displaced fracture of second cervical vertebra, initial encounter for open fracture
	S12.190D	Other displaced fracture of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.190G	Other displaced fracture of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.190K	Other displaced fracture of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.190S	Other displaced fracture of second cervical vertebra, sequela
	S12.191A	Other nondisplaced fracture of second cervical vertebra, initial encounter for closed fracture
	S12.191B	Other nondisplaced fracture of second cervical vertebra, initial encounter for open fracture
	S12.191D	Other nondisplaced fracture of second cervical vertebra, subsequent encounter for fracture with routine healing
	S12.191G	Other nondisplaced fracture of second cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.191K	Other nondisplaced fracture of second cervical vertebra, subsequent encounter for fracture with nonunion
	S12.191S	Other nondisplaced fracture of second cervical vertebra, sequela
	S12.200A	Unspecified displaced fracture of third cervical vertebra, initial encounter for closed fracture
	S12.200B	Unspecified displaced fracture of third cervical vertebra, initial encounter for open fracture

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.200D	Unspecified displaced fracture of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.200G	Unspecified displaced fracture of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.200K	Unspecified displaced fracture of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.200S	Unspecified displaced fracture of third cervical vertebra, sequela
	S12.201A	Unspecified nondisplaced fracture of third cervical vertebra, initial encounter for closed fracture
	S12.201B	Unspecified nondisplaced fracture of third cervical vertebra, initial encounter for open fracture
	S12.201D	Unspecified nondisplaced fracture of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.201G	Unspecified nondisplaced fracture of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.201K	Unspecified nondisplaced fracture of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.201S	Unspecified nondisplaced fracture of third cervical vertebra, sequela
	S12.230A	Unspecified traumatic displaced spondylolisthesis of third cervical vertebra, initial encounter for closed fracture
	S12.230B	Unspecified traumatic displaced spondylolisthesis of third cervical vertebra, initial encounter for open fracture
	S12.230D	Unspecified traumatic displaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.230G	Unspecified traumatic displaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.230K	Unspecified traumatic displaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.230S	Unspecified traumatic displaced spondylolisthesis of third cervical vertebra, sequela
	S12.231A	Unspecified traumatic nondisplaced spondylolisthesis of third cervical vertebra, initial encounter for closed fracture
	S12.231B	Unspecified traumatic nondisplaced spondylolisthesis of third cervical vertebra, initial encounter for open fracture
	S12.231D	Unspecified traumatic nondisplaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.231G	Unspecified traumatic nondisplaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.231K	Unspecified traumatic nondisplaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.231S	Unspecified traumatic nondisplaced spondylolisthesis of third cervical vertebra, sequela
	S12.24XA	Type III traumatic spondylolisthesis of third cervical vertebra, initial encounter for closed fracture
	S12.24XB	Type III traumatic spondylolisthesis of third cervical vertebra, initial encounter for open fracture
	S12.24XD	Type III traumatic spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.24XG	Type III traumatic spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.24XK	Type III traumatic spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.24XS	Type III traumatic spondylolisthesis of third cervical vertebra, sequela
	S12.250A	Other traumatic displaced spondylolisthesis of third cervical vertebra, initial encounter for closed fracture
	S12.250B	Other traumatic displaced spondylolisthesis of third cervical vertebra, initial encounter for open fracture
	S12.250D	Other traumatic displaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.250G	Other traumatic displaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.250K	Other traumatic displaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.250S	Other traumatic displaced spondylolisthesis of third cervical vertebra, sequela
	S12.251A	Other traumatic nondisplaced spondylolisthesis of third cervical vertebra, initial encounter for closed fracture
	S12.251B	Other traumatic nondisplaced spondylolisthesis of third cervical vertebra, initial encounter for open fracture

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.251D	Other traumatic nondisplaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.251G	Other traumatic nondisplaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.251K	Other traumatic nondisplaced spondylolisthesis of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.251S	Other traumatic nondisplaced spondylolisthesis of third cervical vertebra, sequela
	S12.290A	Other displaced fracture of third cervical vertebra, initial encounter for closed fracture
	S12.290B	Other displaced fracture of third cervical vertebra, initial encounter for open fracture
	S12.290D	Other displaced fracture of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.290G	Other displaced fracture of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.290K	Other displaced fracture of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.290S	Other displaced fracture of third cervical vertebra, sequela
	S12.291A	Other nondisplaced fracture of third cervical vertebra, initial encounter for closed fracture
	S12.291B	Other nondisplaced fracture of third cervical vertebra, initial encounter for open fracture
	S12.291D	Other nondisplaced fracture of third cervical vertebra, subsequent encounter for fracture with routine healing
	S12.291G	Other nondisplaced fracture of third cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.291K	Other nondisplaced fracture of third cervical vertebra, subsequent encounter for fracture with nonunion
	S12.291S	Other nondisplaced fracture of third cervical vertebra, sequela
	S12.300A	Unspecified displaced fracture of fourth cervical vertebra, initial encounter for closed fracture
	S12.300B	Unspecified displaced fracture of fourth cervical vertebra, initial encounter for open fracture
	S12.300D	Unspecified displaced fracture of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.300G	Unspecified displaced fracture of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.300K	Unspecified displaced fracture of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.300S	Unspecified displaced fracture of fourth cervical vertebra, sequela
	S12.301A	Unspecified nondisplaced fracture of fourth cervical vertebra, initial encounter for closed fracture
	S12.301B	Unspecified nondisplaced fracture of fourth cervical vertebra, initial encounter for open fracture
	S12.301D	Unspecified nondisplaced fracture of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.301G	Unspecified nondisplaced fracture of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.301K	Unspecified nondisplaced fracture of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.301S	Unspecified nondisplaced fracture of fourth cervical vertebra, sequela
	S12.330A	Unspecified traumatic displaced spondylolisthesis of fourth cervical vertebra, initial encounter for closed fracture
	S12.330B	Unspecified traumatic displaced spondylolisthesis of fourth cervical vertebra, initial encounter for open fracture
	S12.330D	Unspecified traumatic displaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.330G	Unspecified traumatic displaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.330K	Unspecified traumatic displaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.330S	Unspecified traumatic displaced spondylolisthesis of fourth cervical vertebra, sequela
	S12.331A	Unspecified traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, initial encounter for closed fracture
	S12.331B	Unspecified traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, initial encounter for open fracture
	S12.331D	Unspecified traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.331G	Unspecified traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with delayed healing

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.331K	Unspecified traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.331S	Unspecified traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, sequela
	S12.34XA	Type III traumatic spondylolisthesis of fourth cervical vertebra, initial encounter for closed fracture
	S12.34XB	Type III traumatic spondylolisthesis of fourth cervical vertebra, initial encounter for open fracture
	S12.34XD	Type III traumatic spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.34XG	Type III traumatic spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.34XK	Type III traumatic spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.34XS	Type III traumatic spondylolisthesis of fourth cervical vertebra, sequela
	S12.350A	Other traumatic displaced spondylolisthesis of fourth cervical vertebra, initial encounter for closed fracture
	S12.350B	Other traumatic displaced spondylolisthesis of fourth cervical vertebra, initial encounter for open fracture
	S12.350D	Other traumatic displaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.350G	Other traumatic displaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.350K	Other traumatic displaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.350S	Other traumatic displaced spondylolisthesis of fourth cervical vertebra, sequela
	S12.351A	Other traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, initial encounter for closed fracture
	S12.351B	Other traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, initial encounter for open fracture
	S12.351D	Other traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.351G	Other traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.351K	Other traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.351S	Other traumatic nondisplaced spondylolisthesis of fourth cervical vertebra, sequela
	S12.390A	Other displaced fracture of fourth cervical vertebra, initial encounter for closed fracture
	S12.390B	Other displaced fracture of fourth cervical vertebra, initial encounter for open fracture
	S12.390D	Other displaced fracture of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.390G	Other displaced fracture of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.390K	Other displaced fracture of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.390S	Other displaced fracture of fourth cervical vertebra, sequela
	S12.391A	Other nondisplaced fracture of fourth cervical vertebra, initial encounter for closed fracture
	S12.391B	Other nondisplaced fracture of fourth cervical vertebra, initial encounter for open fracture
	S12.391D	Other nondisplaced fracture of fourth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.391G	Other nondisplaced fracture of fourth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.391K	Other nondisplaced fracture of fourth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.391S	Other nondisplaced fracture of fourth cervical vertebra, sequela
	S12.400A	Unspecified displaced fracture of fifth cervical vertebra, initial encounter for closed fracture
	S12.400B	Unspecified displaced fracture of fifth cervical vertebra, initial encounter for open fracture
	S12.400D	Unspecified displaced fracture of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.400G	Unspecified displaced fracture of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.400K	Unspecified displaced fracture of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.400S	Unspecified displaced fracture of fifth cervical vertebra, sequela

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.401A	Unspecified nondisplaced fracture of fifth cervical vertebra, initial encounter for closed fracture
	S12.401B	Unspecified nondisplaced fracture of fifth cervical vertebra, initial encounter for open fracture
	S12.401D	Unspecified nondisplaced fracture of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.401G	Unspecified nondisplaced fracture of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.401K	Unspecified nondisplaced fracture of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.401S	Unspecified nondisplaced fracture of fifth cervical vertebra, sequela
	S12.430A	Unspecified traumatic displaced spondylolisthesis of fifth cervical vertebra, initial encounter for closed fracture
	S12.430B	Unspecified traumatic displaced spondylolisthesis of fifth cervical vertebra, initial encounter for open fracture
	S12.430D	Unspecified traumatic displaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.430G	Unspecified traumatic displaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.430K	Unspecified traumatic displaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.430S	Unspecified traumatic displaced spondylolisthesis of fifth cervical vertebra, sequela
	S12.431A	Unspecified traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, initial encounter for closed fracture
	S12.431B	Unspecified traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, initial encounter for open fracture
	S12.431D	Unspecified traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.431G	Unspecified traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.431K	Unspecified traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.431S	Unspecified traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, sequela
	S12.44XA	Type III traumatic spondylolisthesis of fifth cervical vertebra, initial encounter for closed fracture
	S12.44XB	Type III traumatic spondylolisthesis of fifth cervical vertebra, initial encounter for open fracture
	S12.44XD	Type III traumatic spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.44XG	Type III traumatic spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.44XK	Type III traumatic spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.44XS	Type III traumatic spondylolisthesis of fifth cervical vertebra, sequela
	S12.450A	Other traumatic displaced spondylolisthesis of fifth cervical vertebra, initial encounter for closed fracture
	S12.450B	Other traumatic displaced spondylolisthesis of fifth cervical vertebra, initial encounter for open fracture
	S12.450D	Other traumatic displaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.450G	Other traumatic displaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.450K	Other traumatic displaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.450S	Other traumatic displaced spondylolisthesis of fifth cervical vertebra, sequela
	S12.451A	Other traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, initial encounter for closed fracture
	S12.451B	Other traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, initial encounter for open fracture
	S12.451D	Other traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.451G	Other traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.451K	Other traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.451S	Other traumatic nondisplaced spondylolisthesis of fifth cervical vertebra, sequela

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.490A	Other displaced fracture of fifth cervical vertebra, initial encounter for closed fracture
	S12.490B	Other displaced fracture of fifth cervical vertebra, initial encounter for open fracture
	S12.490D	Other displaced fracture of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.490G	Other displaced fracture of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.490K	Other displaced fracture of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.490S	Other displaced fracture of fifth cervical vertebra, sequela
	S12.491A	Other nondisplaced fracture of fifth cervical vertebra, initial encounter for closed fracture
	S12.491B	Other nondisplaced fracture of fifth cervical vertebra, initial encounter for open fracture
	S12.491D	Other nondisplaced fracture of fifth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.491G	Other nondisplaced fracture of fifth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.491K	Other nondisplaced fracture of fifth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.491S	Other nondisplaced fracture of fifth cervical vertebra, sequela
	S12.500A	Unspecified displaced fracture of sixth cervical vertebra, initial encounter for closed fracture
	S12.500B	Unspecified displaced fracture of sixth cervical vertebra, initial encounter for open fracture
	S12.500D	Unspecified displaced fracture of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.500G	Unspecified displaced fracture of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.500K	Unspecified displaced fracture of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.500S	Unspecified displaced fracture of sixth cervical vertebra, sequela
	S12.501A	Unspecified nondisplaced fracture of sixth cervical vertebra, initial encounter for closed fracture
	S12.501B	Unspecified nondisplaced fracture of sixth cervical vertebra, initial encounter for open fracture
	S12.501D	Unspecified nondisplaced fracture of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.501G	Unspecified nondisplaced fracture of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.501K	Unspecified nondisplaced fracture of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.501S	Unspecified nondisplaced fracture of sixth cervical vertebra, sequela
	S12.530A	Unspecified traumatic displaced spondylolisthesis of sixth cervical vertebra, initial encounter for closed fracture
	S12.530B	Unspecified traumatic displaced spondylolisthesis of sixth cervical vertebra, initial encounter for open fracture
	S12.530D	Unspecified traumatic displaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.530G	Unspecified traumatic displaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.530K	Unspecified traumatic displaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.530S	Unspecified traumatic displaced spondylolisthesis of sixth cervical vertebra, sequela
	S12.531A	Unspecified traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, initial encounter for closed fracture
	S12.531B	Unspecified traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, initial encounter for open fracture
	S12.531D	Unspecified traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.531G	Unspecified traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.531K	Unspecified traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.531S	Unspecified traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, sequela
	S12.54XA	Type III traumatic spondylolisthesis of sixth cervical vertebra, initial encounter for closed fracture
	S12.54XB	Type III traumatic spondylolisthesis of sixth cervical vertebra, initial encounter for open fracture
	S12.54XD	Type III traumatic spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with routine healing



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.54XG	Type III traumatic spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.54XK	Type III traumatic spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.54XS	Type III traumatic spondylolisthesis of sixth cervical vertebra, sequela
	S12.550A	Other traumatic displaced spondylolisthesis of sixth cervical vertebra, initial encounter for closed fracture
	S12.550B	Other traumatic displaced spondylolisthesis of sixth cervical vertebra, initial encounter for open fracture
	S12.550D	Other traumatic displaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.550G	Other traumatic displaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.550K	Other traumatic displaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.550S	Other traumatic displaced spondylolisthesis of sixth cervical vertebra, sequela
	S12.551A	Other traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, initial encounter for closed fracture
	S12.551B	Other traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, initial encounter for open fracture
	S12.551D	Other traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.551G	Other traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.551K	Other traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.551S	Other traumatic nondisplaced spondylolisthesis of sixth cervical vertebra, sequela
	S12.590A	Other displaced fracture of sixth cervical vertebra, initial encounter for closed fracture
	S12.590B	Other displaced fracture of sixth cervical vertebra, initial encounter for open fracture
	S12.590D	Other displaced fracture of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.590G	Other displaced fracture of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.590K	Other displaced fracture of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.590S	Other displaced fracture of sixth cervical vertebra, sequela
	S12.591A	Other nondisplaced fracture of sixth cervical vertebra, initial encounter for closed fracture
	S12.591B	Other nondisplaced fracture of sixth cervical vertebra, initial encounter for open fracture
	S12.591D	Other nondisplaced fracture of sixth cervical vertebra, subsequent encounter for fracture with routine healing
	S12.591G	Other nondisplaced fracture of sixth cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.591K	Other nondisplaced fracture of sixth cervical vertebra, subsequent encounter for fracture with nonunion
	S12.591S	Other nondisplaced fracture of sixth cervical vertebra, sequela
	S12.600A	Unspecified displaced fracture of seventh cervical vertebra, initial encounter for closed fracture
	S12.600B	Unspecified displaced fracture of seventh cervical vertebra, initial encounter for open fracture
	S12.600D	Unspecified displaced fracture of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.600G	Unspecified displaced fracture of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.600K	Unspecified displaced fracture of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.600S	Unspecified displaced fracture of seventh cervical vertebra, sequela
	S12.601A	Unspecified nondisplaced fracture of seventh cervical vertebra, initial encounter for closed fracture
	S12.601B	Unspecified nondisplaced fracture of seventh cervical vertebra, initial encounter for open fracture
	S12.601D	Unspecified nondisplaced fracture of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.601G	Unspecified nondisplaced fracture of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.601K	Unspecified nondisplaced fracture of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.601S	Unspecified nondisplaced fracture of seventh cervical vertebra, sequela



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.630A	Unspecified traumatic displaced spondylolisthesis of seventh cervical vertebra, initial encounter for closed fracture
	S12.630B	Unspecified traumatic displaced spondylolisthesis of seventh cervical vertebra, initial encounter for open fracture
	S12.630D	Unspecified traumatic displaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.630G	Unspecified traumatic displaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.630K	Unspecified traumatic displaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.630S	Unspecified traumatic displaced spondylolisthesis of seventh cervical vertebra, sequela
	S12.631A	Unspecified traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, initial encounter for closed fracture
	S12.631B	Unspecified traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, initial encounter for open fracture
	S12.631D	Unspecified traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.631G	Unspecified traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.631K	Unspecified traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.631S	Unspecified traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, sequela
	S12.64XA	Type III traumatic spondylolisthesis of seventh cervical vertebra, initial encounter for closed fracture
	S12.64XB	Type III traumatic spondylolisthesis of seventh cervical vertebra, initial encounter for open fracture
	S12.64XD	Type III traumatic spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.64XG	Type III traumatic spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.64XK	Type III traumatic spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.64XS	Type III traumatic spondylolisthesis of seventh cervical vertebra, sequela
	S12.650A	Other traumatic displaced spondylolisthesis of seventh cervical vertebra, initial encounter for closed fracture
	S12.650B	Other traumatic displaced spondylolisthesis of seventh cervical vertebra, initial encounter for open fracture
	S12.650D	Other traumatic displaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.650G	Other traumatic displaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.650K	Other traumatic displaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.650S	Other traumatic displaced spondylolisthesis of seventh cervical vertebra, sequela
	S12.651A	Other traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, initial encounter for closed fracture
	S12.651B	Other traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, initial encounter for open fracture
	S12.651D	Other traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.651G	Other traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.651K	Other traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.651S	Other traumatic nondisplaced spondylolisthesis of seventh cervical vertebra, sequela
	S12.690A	Other displaced fracture of seventh cervical vertebra, initial encounter for closed fracture
	S12.690B	Other displaced fracture of seventh cervical vertebra, initial encounter for open fracture
	S12.690D	Other displaced fracture of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.690G	Other displaced fracture of seventh cervical vertebra, subsequent encounter for fracture with delayed healing

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S12.690K	Other displaced fracture of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.690S	Other displaced fracture of seventh cervical vertebra, sequela
	S12.691A	Other nondisplaced fracture of seventh cervical vertebra, initial encounter for closed fracture
	S12.691B	Other nondisplaced fracture of seventh cervical vertebra, initial encounter for open fracture
	S12.691D	Other nondisplaced fracture of seventh cervical vertebra, subsequent encounter for fracture with routine healing
	S12.691G	Other nondisplaced fracture of seventh cervical vertebra, subsequent encounter for fracture with delayed healing
	S12.691K	Other nondisplaced fracture of seventh cervical vertebra, subsequent encounter for fracture with nonunion
	S12.691S	Other nondisplaced fracture of seventh cervical vertebra, sequela
	S12.9XXA	Fracture of neck, unspecified, initial encounter
	S12.9XXD	Fracture of neck, unspecified, subsequent encounter
	S12.9XXS	Fracture of neck, unspecified, sequela
	S13.0XXA	Traumatic rupture of cervical intervertebral disc, initial encounter
	S13.0XXD	Traumatic rupture of cervical intervertebral disc, subsequent encounter
	S13.0XXS	Traumatic rupture of cervical intervertebral disc, sequela
	S13.100A	Subluxation of unspecified cervical vertebrae, initial encounter
	S13.100D	Subluxation of unspecified cervical vertebrae, subsequent encounter
	S13.100S	Subluxation of unspecified cervical vertebrae, sequela
	S13.101A	Dislocation of unspecified cervical vertebrae, initial encounter
	S13.101D	Dislocation of unspecified cervical vertebrae, subsequent encounter
	S13.101S	Dislocation of unspecified cervical vertebrae, sequela
	S13.110A	Subluxation of C0/C1 cervical vertebrae, initial encounter
	S13.110D	Subluxation of C0/C1 cervical vertebrae, subsequent encounter
	S13.110S	Subluxation of C0/C1 cervical vertebrae, sequela
	S13.111A	Dislocation of C0/C1 cervical vertebrae, initial encounter
	S13.111D	Dislocation of C0/C1 cervical vertebrae, subsequent encounter
	S13.111S	Dislocation of C0/C1 cervical vertebrae, sequela
	S13.120A	Subluxation of C1/C2 cervical vertebrae, initial encounter
	S13.120D	Subluxation of C1/C2 cervical vertebrae, subsequent encounter
	S13.120S	Subluxation of C1/C2 cervical vertebrae, sequela
	S13.121A	Dislocation of C1/C2 cervical vertebrae, initial encounter
	S13.121D	Dislocation of C1/C2 cervical vertebrae, subsequent encounter
	S13.121S	Dislocation of C1/C2 cervical vertebrae, sequela
	S13.130A	Subluxation of C2/C3 cervical vertebrae, initial encounter
	S13.130D	Subluxation of C2/C3 cervical vertebrae, subsequent encounter
	S13.130S	Subluxation of C2/C3 cervical vertebrae, sequela
	S13.131A	Dislocation of C2/C3 cervical vertebrae, initial encounter
	S13.131D	Dislocation of C2/C3 cervical vertebrae, subsequent encounter
	S13.131S	Dislocation of C2/C3 cervical vertebrae, sequela
	S13.140A	Subluxation of C3/C4 cervical vertebrae, initial encounter
	S13.140D	Subluxation of C3/C4 cervical vertebrae, subsequent encounter
	S13.140S	Subluxation of C3/C4 cervical vertebrae, sequela
	S13.141A	Dislocation of C3/C4 cervical vertebrae, initial encounter
	S13.141D	Dislocation of C3/C4 cervical vertebrae, subsequent encounter

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S13.141S	Dislocation of C3/C4 cervical vertebrae, sequela
	S13.150A	Subluxation of C4/C5 cervical vertebrae, initial encounter
	S13.150D	Subluxation of C4/C5 cervical vertebrae, subsequent encounter
	S13.150S	Subluxation of C4/C5 cervical vertebrae, sequela
	S13.151A	Dislocation of C4/C5 cervical vertebrae, initial encounter
	S13.151D	Dislocation of C4/C5 cervical vertebrae, subsequent encounter
	S13.151S	Dislocation of C4/C5 cervical vertebrae, sequela
	S13.160A	Subluxation of C5/C6 cervical vertebrae, initial encounter
	S13.160D	Subluxation of C5/C6 cervical vertebrae, subsequent encounter
	S13.160S	Subluxation of C5/C6 cervical vertebrae, sequela
	S13.161A	Dislocation of C5/C6 cervical vertebrae, initial encounter
	S13.161D	Dislocation of C5/C6 cervical vertebrae, subsequent encounter
	S13.161S	Dislocation of C5/C6 cervical vertebrae, sequela
	S13.170A	Subluxation of C6/C7 cervical vertebrae, initial encounter
	S13.170D	Subluxation of C6/C7 cervical vertebrae, subsequent encounter
	S13.170S	Subluxation of C6/C7 cervical vertebrae, sequela
	S13.171A	Dislocation of C6/C7 cervical vertebrae, initial encounter
	S13.171D	Dislocation of C6/C7 cervical vertebrae, subsequent encounter
	S13.171S	Dislocation of C6/C7 cervical vertebrae, sequela
	S13.180A	Subluxation of C7/T1 cervical vertebrae, initial encounter
	S13.180D	Subluxation of C7/T1 cervical vertebrae, subsequent encounter
	S13.180S	Subluxation of C7/T1 cervical vertebrae, sequela
	S13.181A	Dislocation of C7/T1 cervical vertebrae, initial encounter
	S13.181D	Dislocation of C7/T1 cervical vertebrae, subsequent encounter
	S13.181S	Dislocation of C7/T1 cervical vertebrae, sequela
	S22.000A	Wedge compression fracture of unspecified thoracic vertebra, initial encounter for closed fracture
	S22.000B	Wedge compression fracture of unspecified thoracic vertebra, initial encounter for open fracture
	S22.000D	Wedge compression fracture of unspecified thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.000G	Wedge compression fracture of unspecified thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.000K	Wedge compression fracture of unspecified thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.000S	Wedge compression fracture of unspecified thoracic vertebra, sequela
	S22.001A	Stable burst fracture of unspecified thoracic vertebra, initial encounter for closed fracture
	S22.001B	Stable burst fracture of unspecified thoracic vertebra, initial encounter for open fracture
	S22.001D	Stable burst fracture of unspecified thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.001G	Stable burst fracture of unspecified thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.001K	Stable burst fracture of unspecified thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.001S	Stable burst fracture of unspecified thoracic vertebra, sequela
	S22.002A	Unstable burst fracture of unspecified thoracic vertebra, initial encounter for closed fracture
	S22.002B	Unstable burst fracture of unspecified thoracic vertebra, initial encounter for open fracture
	S22.002D	Unstable burst fracture of unspecified thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.002G	Unstable burst fracture of unspecified thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.002K	Unstable burst fracture of unspecified thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.002S	Unstable burst fracture of unspecified thoracic vertebra, sequela

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S22.008A	Other fracture of unspecified thoracic vertebra, initial encounter for closed fracture
	S22.008B	Other fracture of unspecified thoracic vertebra, initial encounter for open fracture
	S22.008D	Other fracture of unspecified thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.008G	Other fracture of unspecified thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.008K	Other fracture of unspecified thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.008S	Other fracture of unspecified thoracic vertebra, sequela
	S22.009A	Unspecified fracture of unspecified thoracic vertebra, initial encounter for closed fracture
	S22.009B	Unspecified fracture of unspecified thoracic vertebra, initial encounter for open fracture
	S22.009D	Unspecified fracture of unspecified thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.009G	Unspecified fracture of unspecified thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.009K	Unspecified fracture of unspecified thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.009S	Unspecified fracture of unspecified thoracic vertebra, sequela
	S22.010A	Wedge compression fracture of first thoracic vertebra, initial encounter for closed fracture
	S22.010B	Wedge compression fracture of first thoracic vertebra, initial encounter for open fracture
	S22.010D	Wedge compression fracture of first thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.010G	Wedge compression fracture of first thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.010K	Wedge compression fracture of first thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.010S	Wedge compression fracture of first thoracic vertebra, sequela
	S22.011A	Stable burst fracture of first thoracic vertebra, initial encounter for closed fracture
	S22.011B	Stable burst fracture of first thoracic vertebra, initial encounter for open fracture
	S22.011D	Stable burst fracture of first thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.011G	Stable burst fracture of first thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.011K	Stable burst fracture of first thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.011S	Stable burst fracture of first thoracic vertebra, sequela
	S22.012A	Unstable burst fracture of first thoracic vertebra, initial encounter for closed fracture
	S22.012B	Unstable burst fracture of first thoracic vertebra, initial encounter for open fracture
	S22.012D	Unstable burst fracture of first thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.012G	Unstable burst fracture of first thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.012K	Unstable burst fracture of first thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.012S	Unstable burst fracture of first thoracic vertebra, sequela
	S22.018A	Other fracture of first thoracic vertebra, initial encounter for closed fracture
	S22.018B	Other fracture of first thoracic vertebra, initial encounter for open fracture
	S22.018D	Other fracture of first thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.018G	Other fracture of first thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.018K	Other fracture of first thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.018S	Other fracture of first thoracic vertebra, sequela
	S22.019A	Unspecified fracture of first thoracic vertebra, initial encounter for closed fracture
	S22.019B	Unspecified fracture of first thoracic vertebra, initial encounter for open fracture
	S22.019D	Unspecified fracture of first thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.019G	Unspecified fracture of first thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.019K	Unspecified fracture of first thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.019S	Unspecified fracture of first thoracic vertebra, sequela
	S22.020A	Wedge compression fracture of second thoracic vertebra, initial encounter for closed fracture

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S22.020B	Wedge compression fracture of second thoracic vertebra, initial encounter for open fracture
	S22.020D	Wedge compression fracture of second thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.020G	Wedge compression fracture of second thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.020K	Wedge compression fracture of second thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.020S	Wedge compression fracture of second thoracic vertebra, sequela
	S22.021A	Stable burst fracture of second thoracic vertebra, initial encounter for closed fracture
	S22.021B	Stable burst fracture of second thoracic vertebra, initial encounter for open fracture
	S22.021D	Stable burst fracture of second thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.021G	Stable burst fracture of second thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.021K	Stable burst fracture of second thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.021S	Stable burst fracture of second thoracic vertebra, sequela
	S22.022A	Unstable burst fracture of second thoracic vertebra, initial encounter for closed fracture
	S22.022B	Unstable burst fracture of second thoracic vertebra, initial encounter for open fracture
	S22.022D	Unstable burst fracture of second thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.022G	Unstable burst fracture of second thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.022K	Unstable burst fracture of second thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.022S	Unstable burst fracture of second thoracic vertebra, sequela
	S22.028A	Other fracture of second thoracic vertebra, initial encounter for closed fracture
	S22.028B	Other fracture of second thoracic vertebra, initial encounter for open fracture
	S22.028D	Other fracture of second thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.028G	Other fracture of second thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.028K	Other fracture of second thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.028S	Other fracture of second thoracic vertebra, sequela
	S22.029A	Unspecified fracture of second thoracic vertebra, initial encounter for closed fracture
	S22.029B	Unspecified fracture of second thoracic vertebra, initial encounter for open fracture
	S22.029D	Unspecified fracture of second thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.029G	Unspecified fracture of second thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.029K	Unspecified fracture of second thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.029S	Unspecified fracture of second thoracic vertebra, sequela
	S22.030A	Wedge compression fracture of third thoracic vertebra, initial encounter for closed fracture
	S22.030B	Wedge compression fracture of third thoracic vertebra, initial encounter for open fracture
	S22.030D	Wedge compression fracture of third thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.030G	Wedge compression fracture of third thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.030K	Wedge compression fracture of third thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.030S	Wedge compression fracture of third thoracic vertebra, sequela
	S22.031A	Stable burst fracture of third thoracic vertebra, initial encounter for closed fracture
	S22.031B	Stable burst fracture of third thoracic vertebra, initial encounter for open fracture
	S22.031D	Stable burst fracture of third thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.031G	Stable burst fracture of third thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.031K	Stable burst fracture of third thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.031S	Stable burst fracture of third thoracic vertebra, sequela
	S22.032A	Unstable burst fracture of third thoracic vertebra, initial encounter for closed fracture
	S22.032B	Unstable burst fracture of third thoracic vertebra, initial encounter for open fracture

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S22.032D	Unstable burst fracture of third thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.032G	Unstable burst fracture of third thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.032K	Unstable burst fracture of third thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.032S	Unstable burst fracture of third thoracic vertebra, sequela
	S22.038A	Other fracture of third thoracic vertebra, initial encounter for closed fracture
	S22.038B	Other fracture of third thoracic vertebra, initial encounter for open fracture
	S22.038D	Other fracture of third thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.038G	Other fracture of third thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.038K	Other fracture of third thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.038S	Other fracture of third thoracic vertebra, sequela
	S22.039A	Unspecified fracture of third thoracic vertebra, initial encounter for closed fracture
	S22.039B	Unspecified fracture of third thoracic vertebra, initial encounter for open fracture
	S22.039D	Unspecified fracture of third thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.039G	Unspecified fracture of third thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.039K	Unspecified fracture of third thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.039S	Unspecified fracture of third thoracic vertebra, sequela
	S22.040A	Wedge compression fracture of fourth thoracic vertebra, initial encounter for closed fracture
	S22.040B	Wedge compression fracture of fourth thoracic vertebra, initial encounter for open fracture
	S22.040D	Wedge compression fracture of fourth thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.040G	Wedge compression fracture of fourth thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.040K	Wedge compression fracture of fourth thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.040S	Wedge compression fracture of fourth thoracic vertebra, sequela
	S22.041A	Stable burst fracture of fourth thoracic vertebra, initial encounter for closed fracture
	S22.041B	Stable burst fracture of fourth thoracic vertebra, initial encounter for open fracture
	S22.041D	Stable burst fracture of fourth thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.041G	Stable burst fracture of fourth thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.041K	Stable burst fracture of fourth thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.041S	Stable burst fracture of fourth thoracic vertebra, sequela
	S22.042A	Unstable burst fracture of fourth thoracic vertebra, initial encounter for closed fracture
	S22.042B	Unstable burst fracture of fourth thoracic vertebra, initial encounter for open fracture
	S22.042D	Unstable burst fracture of fourth thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.042G	Unstable burst fracture of fourth thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.042K	Unstable burst fracture of fourth thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.042S	Unstable burst fracture of fourth thoracic vertebra, sequela
	S22.048A	Other fracture of fourth thoracic vertebra, initial encounter for closed fracture
	S22.048B	Other fracture of fourth thoracic vertebra, initial encounter for open fracture
	S22.048D	Other fracture of fourth thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.048G	Other fracture of fourth thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.048K	Other fracture of fourth thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.048S	Other fracture of fourth thoracic vertebra, sequela
	S22.049A	Unspecified fracture of fourth thoracic vertebra, initial encounter for closed fracture
	S22.049B	Unspecified fracture of fourth thoracic vertebra, initial encounter for open fracture
	S22.049D	Unspecified fracture of fourth thoracic vertebra, subsequent encounter for fracture with routine healing

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S22.049G	Unspecified fracture of fourth thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.049K	Unspecified fracture of fourth thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.049S	Unspecified fracture of fourth thoracic vertebra, sequela
	S22.050A	Wedge compression fracture of T5-T6 vertebra, initial encounter for closed fracture
	S22.050B	Wedge compression fracture of T5-T6 vertebra, initial encounter for open fracture
	S22.050D	Wedge compression fracture of T5-T6 vertebra, subsequent encounter for fracture with routine healing
	S22.050G	Wedge compression fracture of T5-T6 vertebra, subsequent encounter for fracture with delayed healing
	S22.050K	Wedge compression fracture of T5-T6 vertebra, subsequent encounter for fracture with nonunion
	S22.050S	Wedge compression fracture of T5-T6 vertebra, sequela
	S22.051A	Stable burst fracture of T5-T6 vertebra, initial encounter for closed fracture
	S22.051B	Stable burst fracture of T5-T6 vertebra, initial encounter for open fracture
	S22.051D	Stable burst fracture of T5-T6 vertebra, subsequent encounter for fracture with routine healing
	S22.051G	Stable burst fracture of T5-T6 vertebra, subsequent encounter for fracture with delayed healing
	S22.051K	Stable burst fracture of T5-T6 vertebra, subsequent encounter for fracture with nonunion
	S22.051S	Stable burst fracture of T5-T6 vertebra, sequela
	S22.052A	Unstable burst fracture of T5-T6 vertebra, initial encounter for closed fracture
	S22.052B	Unstable burst fracture of T5-T6 vertebra, initial encounter for open fracture
	S22.052D	Unstable burst fracture of T5-T6 vertebra, subsequent encounter for fracture with routine healing
	S22.052G	Unstable burst fracture of T5-T6 vertebra, subsequent encounter for fracture with delayed healing
	S22.052K	Unstable burst fracture of T5-T6 vertebra, subsequent encounter for fracture with nonunion
	S22.052S	Unstable burst fracture of T5-T6 vertebra, sequela
	S22.058A	Other fracture of T5-T6 vertebra, initial encounter for closed fracture
	S22.058B	Other fracture of T5-T6 vertebra, initial encounter for open fracture
	S22.058D	Other fracture of T5-T6 vertebra, subsequent encounter for fracture with routine healing
	S22.058G	Other fracture of T5-T6 vertebra, subsequent encounter for fracture with delayed healing
	S22.058K	Other fracture of T5-T6 vertebra, subsequent encounter for fracture with nonunion
	S22.058S	Other fracture of T5-T6 vertebra, sequela
	S22.059A	Unspecified fracture of T5-T6 vertebra, initial encounter for closed fracture
	S22.059B	Unspecified fracture of T5-T6 vertebra, initial encounter for open fracture
	S22.059D	Unspecified fracture of T5-T6 vertebra, subsequent encounter for fracture with routine healing
	S22.059G	Unspecified fracture of T5-T6 vertebra, subsequent encounter for fracture with delayed healing
	S22.059K	Unspecified fracture of T5-T6 vertebra, subsequent encounter for fracture with nonunion
	S22.059S	Unspecified fracture of T5-T6 vertebra, sequela
	S22.060A	Wedge compression fracture of T7-T8 vertebra, initial encounter for closed fracture
	S22.060B	Wedge compression fracture of T7-T8 vertebra, initial encounter for open fracture
	S22.060D	Wedge compression fracture of T7-T8 vertebra, subsequent encounter for fracture with routine healing
	S22.060G	Wedge compression fracture of T7-T8 vertebra, subsequent encounter for fracture with delayed healing
	S22.060K	Wedge compression fracture of T7-T8 vertebra, subsequent encounter for fracture with nonunion
	S22.060S	Wedge compression fracture of T7-T8 vertebra, sequela
	S22.061A	Stable burst fracture of T7-T8 vertebra, initial encounter for closed fracture
	S22.061B	Stable burst fracture of T7-T8 vertebra, initial encounter for open fracture
	S22.061D	Stable burst fracture of T7-T8 vertebra, subsequent encounter for fracture with routine healing
	S22.061G	Stable burst fracture of T7-T8 vertebra, subsequent encounter for fracture with delayed healing



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S22.061K	Stable burst fracture of T7-T8 vertebra, subsequent encounter for fracture with nonunion
	S22.061S	Stable burst fracture of T7-T8 vertebra, sequela
	S22.062A	Unstable burst fracture of T7-T8 vertebra, initial encounter for closed fracture
	S22.062B	Unstable burst fracture of T7-T8 vertebra, initial encounter for open fracture
	S22.062D	Unstable burst fracture of T7-T8 vertebra, subsequent encounter for fracture with routine healing
	S22.062G	Unstable burst fracture of T7-T8 vertebra, subsequent encounter for fracture with delayed healing
	S22.062K	Unstable burst fracture of T7-T8 vertebra, subsequent encounter for fracture with nonunion
	S22.062S	Unstable burst fracture of T7-T8 vertebra, sequela
	S22.068A	Other fracture of T7-T8 thoracic vertebra, initial encounter for closed fracture
	S22.068B	Other fracture of T7-T8 thoracic vertebra, initial encounter for open fracture
	S22.068D	Other fracture of T7-T8 thoracic vertebra, subsequent encounter for fracture with routine healing
	S22.068G	Other fracture of T7-T8 thoracic vertebra, subsequent encounter for fracture with delayed healing
	S22.068K	Other fracture of T7-T8 thoracic vertebra, subsequent encounter for fracture with nonunion
	S22.068S	Other fracture of T7-T8 thoracic vertebra, sequela
	S22.069A	Unspecified fracture of T7-T8 vertebra, initial encounter for closed fracture
	S22.069B	Unspecified fracture of T7-T8 vertebra, initial encounter for open fracture
	S22.069D	Unspecified fracture of T7-T8 vertebra, subsequent encounter for fracture with routine healing
	S22.069G	Unspecified fracture of T7-T8 vertebra, subsequent encounter for fracture with delayed healing
	S22.069K	Unspecified fracture of T7-T8 vertebra, subsequent encounter for fracture with nonunion
	S22.069S	Unspecified fracture of T7-T8 vertebra, sequela
	S22.070A	Wedge compression fracture of T9-T10 vertebra, initial encounter for closed fracture
	S22.070B	Wedge compression fracture of T9-T10 vertebra, initial encounter for open fracture
	S22.070D	Wedge compression fracture of T9-T10 vertebra, subsequent encounter for fracture with routine healing
	S22.070G	Wedge compression fracture of T9-T10 vertebra, subsequent encounter for fracture with delayed healing
	S22.070K	Wedge compression fracture of T9-T10 vertebra, subsequent encounter for fracture with nonunion
	S22.070S	Wedge compression fracture of T9-T10 vertebra, sequela
	S22.071A	Stable burst fracture of T9-T10 vertebra, initial encounter for closed fracture
	S22.071B	Stable burst fracture of T9-T10 vertebra, initial encounter for open fracture
	S22.071D	Stable burst fracture of T9-T10 vertebra, subsequent encounter for fracture with routine healing
	S22.071G	Stable burst fracture of T9-T10 vertebra, subsequent encounter for fracture with delayed healing
	S22.071K	Stable burst fracture of T9-T10 vertebra, subsequent encounter for fracture with nonunion
	S22.071S	Stable burst fracture of T9-T10 vertebra, sequela
	S22.072A	Unstable burst fracture of T9-T10 vertebra, initial encounter for closed fracture
	S22.072B	Unstable burst fracture of T9-T10 vertebra, initial encounter for open fracture
	S22.072D	Unstable burst fracture of T9-T10 vertebra, subsequent encounter for fracture with routine healing
	S22.072G	Unstable burst fracture of T9-T10 vertebra, subsequent encounter for fracture with delayed healing
	S22.072K	Unstable burst fracture of T9-T10 vertebra, subsequent encounter for fracture with nonunion
	S22.072S	Unstable burst fracture of T9-T10 vertebra, sequela
	S22.078A	Other fracture of T9-T10 vertebra, initial encounter for closed fracture
	S22.078B	Other fracture of T9-T10 vertebra, initial encounter for open fracture
	S22.078D	Other fracture of T9-T10 vertebra, subsequent encounter for fracture with routine healing
	S22.078G	Other fracture of T9-T10 vertebra, subsequent encounter for fracture with delayed healing
	S22.078K	Other fracture of T9-T10 vertebra, subsequent encounter for fracture with nonunion

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S22.078S	Other fracture of T9-T10 vertebra, sequela
	S22.079A	Unspecified fracture of T9-T10 vertebra, initial encounter for closed fracture
	S22.079B	Unspecified fracture of T9-T10 vertebra, initial encounter for open fracture
	S22.079D	Unspecified fracture of T9-T10 vertebra, subsequent encounter for fracture with routine healing
	S22.079G	Unspecified fracture of T9-T10 vertebra, subsequent encounter for fracture with delayed healing
	S22.079K	Unspecified fracture of T9-T10 vertebra, subsequent encounter for fracture with nonunion
	S22.079S	Unspecified fracture of T9-T10 vertebra, sequela
	S22.080A	Wedge compression fracture of T11-T12 vertebra, initial encounter for closed fracture
	S22.080B	Wedge compression fracture of T11-T12 vertebra, initial encounter for open fracture
	S22.080D	Wedge compression fracture of T11-T12 vertebra, subsequent encounter for fracture with routine healing
	S22.080G	Wedge compression fracture of T11-T12 vertebra, subsequent encounter for fracture with delayed healing
	S22.080K	Wedge compression fracture of T11-T12 vertebra, subsequent encounter for fracture with nonunion
	S22.080S	Wedge compression fracture of T11-T12 vertebra, sequela
	S22.081A	Stable burst fracture of T11-T12 vertebra, initial encounter for closed fracture
	S22.081B	Stable burst fracture of T11-T12 vertebra, initial encounter for open fracture
	S22.081D	Stable burst fracture of T11-T12 vertebra, subsequent encounter for fracture with routine healing
	S22.081G	Stable burst fracture of T11-T12 vertebra, subsequent encounter for fracture with delayed healing
	S22.081K	Stable burst fracture of T11-T12 vertebra, subsequent encounter for fracture with nonunion
	S22.081S	Stable burst fracture of T11-T12 vertebra, sequela
	S22.082A	Unstable burst fracture of T11-T12 vertebra, initial encounter for closed fracture
	S22.082B	Unstable burst fracture of T11-T12 vertebra, initial encounter for open fracture
	S22.082D	Unstable burst fracture of T11-T12 vertebra, subsequent encounter for fracture with routine healing
	S22.082G	Unstable burst fracture of T11-T12 vertebra, subsequent encounter for fracture with delayed healing
	S22.082K	Unstable burst fracture of T11-T12 vertebra, subsequent encounter for fracture with nonunion
	S22.082S	Unstable burst fracture of T11-T12 vertebra, sequela
	S22.088A	Other fracture of T11-T12 vertebra, initial encounter for closed fracture
	S22.088B	Other fracture of T11-T12 vertebra, initial encounter for open fracture
	S22.088D	Other fracture of T11-T12 vertebra, subsequent encounter for fracture with routine healing
	S22.088G	Other fracture of T11-T12 vertebra, subsequent encounter for fracture with delayed healing
	S22.088K	Other fracture of T11-T12 vertebra, subsequent encounter for fracture with nonunion
	S22.088S	Other fracture of T11-T12 vertebra, sequela
	S22.089A	Unspecified fracture of T11-T12 vertebra, initial encounter for closed fracture
	S22.089B	Unspecified fracture of T11-T12 vertebra, initial encounter for open fracture
	S22.089D	Unspecified fracture of T11-T12 vertebra, subsequent encounter for fracture with routine healing
	S22.089G	Unspecified fracture of T11-T12 vertebra, subsequent encounter for fracture with delayed healing
	S22.089K	Unspecified fracture of T11-T12 vertebra, subsequent encounter for fracture with nonunion
	S22.089S	Unspecified fracture of T11-T12 vertebra, sequela
	S23.0XXA	Traumatic rupture of thoracic intervertebral disc, initial encounter
	S23.0XXD	Traumatic rupture of thoracic intervertebral disc, subsequent encounter
	S23.0XXS	Traumatic rupture of thoracic intervertebral disc, sequela
	S23.100A	Subluxation of unspecified thoracic vertebra, initial encounter
	S23.100D	Subluxation of unspecified thoracic vertebra, subsequent encounter
	S23.100S	Subluxation of unspecified thoracic vertebra, sequela

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S23.101A	Dislocation of unspecified thoracic vertebra, initial encounter
	S23.101D	Dislocation of unspecified thoracic vertebra, subsequent encounter
	S23.101S	Dislocation of unspecified thoracic vertebra, sequela
	S23.110A	Subluxation of T1/T2 thoracic vertebra, initial encounter
	S23.110D	Subluxation of T1/T2 thoracic vertebra, subsequent encounter
	S23.110S	Subluxation of T1/T2 thoracic vertebra, sequela
	S23.111A	Dislocation of T1/T2 thoracic vertebra, initial encounter
	S23.111D	Dislocation of T1/T2 thoracic vertebra, subsequent encounter
	S23.111S	Dislocation of T1/T2 thoracic vertebra, sequela
	S23.120A	Subluxation of T2/T3 thoracic vertebra, initial encounter
	S23.120D	Subluxation of T2/T3 thoracic vertebra, subsequent encounter
	S23.120S	Subluxation of T2/T3 thoracic vertebra, sequela
	S23.121A	Dislocation of T2/T3 thoracic vertebra, initial encounter
	S23.121D	Dislocation of T2/T3 thoracic vertebra, subsequent encounter
	S23.121S	Dislocation of T2/T3 thoracic vertebra, sequela
	S23.122A	Subluxation of T3/T4 thoracic vertebra, initial encounter
	S23.122D	Subluxation of T3/T4 thoracic vertebra, subsequent encounter
	S23.122S	Subluxation of T3/T4 thoracic vertebra, sequela
	S23.123A	Dislocation of T3/T4 thoracic vertebra, initial encounter
	S23.123D	Dislocation of T3/T4 thoracic vertebra, subsequent encounter
	S23.123S	Dislocation of T3/T4 thoracic vertebra, sequela
	S23.130A	Subluxation of T4/T5 thoracic vertebra, initial encounter
	S23.130D	Subluxation of T4/T5 thoracic vertebra, subsequent encounter
	S23.130S	Subluxation of T4/T5 thoracic vertebra, sequela
	S23.131A	Dislocation of T4/T5 thoracic vertebra, initial encounter
	S23.131D	Dislocation of T4/T5 thoracic vertebra, subsequent encounter
	S23.131S	Dislocation of T4/T5 thoracic vertebra, sequela
	S23.132A	Subluxation of T5/T6 thoracic vertebra, initial encounter
	S23.132D	Subluxation of T5/T6 thoracic vertebra, subsequent encounter
	S23.132S	Subluxation of T5/T6 thoracic vertebra, sequela
	S23.133A	Dislocation of T5/T6 thoracic vertebra, initial encounter
	S23.133D	Dislocation of T5/T6 thoracic vertebra, subsequent encounter
	S23.133S	Dislocation of T5/T6 thoracic vertebra, sequela
	S23.140A	Subluxation of T6/T7 thoracic vertebra, initial encounter
	S23.140D	Subluxation of T6/T7 thoracic vertebra, subsequent encounter
	S23.140S	Subluxation of T6/T7 thoracic vertebra, sequela
	S23.141A	Dislocation of T6/T7 thoracic vertebra, initial encounter
	S23.141D	Dislocation of T6/T7 thoracic vertebra, subsequent encounter
	S23.141S	Dislocation of T6/T7 thoracic vertebra, sequela
	S23.142A	Subluxation of T7/T8 thoracic vertebra, initial encounter
	S23.142D	Subluxation of T7/T8 thoracic vertebra, subsequent encounter
	S23.142S	Subluxation of T7/T8 thoracic vertebra, sequela
	S23.143A	Dislocation of T7/T8 thoracic vertebra, initial encounter

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S23.143D	Dislocation of T7/T8 thoracic vertebra, subsequent encounter
	S23.143S	Dislocation of T7/T8 thoracic vertebra, sequela
	S23.150A	Subluxation of T8/T9 thoracic vertebra, initial encounter
	S23.150D	Subluxation of T8/T9 thoracic vertebra, subsequent encounter
	S23.150S	Subluxation of T8/T9 thoracic vertebra, sequela
	S23.151A	Dislocation of T8/T9 thoracic vertebra, initial encounter
	S23.151D	Dislocation of T8/T9 thoracic vertebra, subsequent encounter
	S23.151S	Dislocation of T8/T9 thoracic vertebra, sequela
	S23.152A	Subluxation of T9/T10 thoracic vertebra, initial encounter
	S23.152D	Subluxation of T9/T10 thoracic vertebra, subsequent encounter
	S23.152S	Subluxation of T9/T10 thoracic vertebra, sequela
	S23.153A	Dislocation of T9/T10 thoracic vertebra, initial encounter
	S23.153D	Dislocation of T9/T10 thoracic vertebra, subsequent encounter
	S23.153S	Dislocation of T9/T10 thoracic vertebra, sequela
	S23.160A	Subluxation of T10/T11 thoracic vertebra, initial encounter
	S23.160D	Subluxation of T10/T11 thoracic vertebra, subsequent encounter
	S23.160S	Subluxation of T10/T11 thoracic vertebra, sequela
	S23.161A	Dislocation of T10/T11 thoracic vertebra, initial encounter
	S23.161D	Dislocation of T10/T11 thoracic vertebra, subsequent encounter
	S23.161S	Dislocation of T10/T11 thoracic vertebra, sequela
	S23.162A	Subluxation of T11/T12 thoracic vertebra, initial encounter
	S23.162D	Subluxation of T11/T12 thoracic vertebra, subsequent encounter
	S23.162S	Subluxation of T11/T12 thoracic vertebra, sequela
	S23.163A	Dislocation of T11/T12 thoracic vertebra, initial encounter
	S23.163D	Dislocation of T11/T12 thoracic vertebra, subsequent encounter
	S23.163S	Dislocation of T11/T12 thoracic vertebra, sequela
	S23.170A	Subluxation of T12/L1 thoracic vertebra, initial encounter
	S23.170D	Subluxation of T12/L1 thoracic vertebra, subsequent encounter
	S23.170S	Subluxation of T12/L1 thoracic vertebra, sequela
	S23.171A	Dislocation of T12/L1 thoracic vertebra, initial encounter
	S23.171D	Dislocation of T12/L1 thoracic vertebra, subsequent encounter
	S23.171S	Dislocation of T12/L1 thoracic vertebra, sequela
	S32.000A	Wedge compression fracture of unspecified lumbar vertebra, initial encounter for closed fracture
	S32.000B	Wedge compression fracture of unspecified lumbar vertebra, initial encounter for open fracture
	S32.000D	Wedge compression fracture of unspecified lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.000G	Wedge compression fracture of unspecified lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.000K	Wedge compression fracture of unspecified lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.000S	Wedge compression fracture of unspecified lumbar vertebra, sequela
	S32.001A	Stable burst fracture of unspecified lumbar vertebra, initial encounter for closed fracture
	S32.001B	Stable burst fracture of unspecified lumbar vertebra, initial encounter for open fracture
	S32.001D	Stable burst fracture of unspecified lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.001G	Stable burst fracture of unspecified lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.001K	Stable burst fracture of unspecified lumbar vertebra, subsequent encounter for fracture with nonunion

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.001S	Stable burst fracture of unspecified lumbar vertebra, sequela
	S32.002A	Unstable burst fracture of unspecified lumbar vertebra, initial encounter for closed fracture
	S32.002B	Unstable burst fracture of unspecified lumbar vertebra, initial encounter for open fracture
	S32.002D	Unstable burst fracture of unspecified lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.002G	Unstable burst fracture of unspecified lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.002K	Unstable burst fracture of unspecified lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.002S	Unstable burst fracture of unspecified lumbar vertebra, sequela
	S32.008A	Other fracture of unspecified lumbar vertebra, initial encounter for closed fracture
	S32.008B	Other fracture of unspecified lumbar vertebra, initial encounter for open fracture
	S32.008D	Other fracture of unspecified lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.008G	Other fracture of unspecified lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.008K	Other fracture of unspecified lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.008S	Other fracture of unspecified lumbar vertebra, sequela
	S32.009A	Unspecified fracture of unspecified lumbar vertebra, initial encounter for closed fracture
	S32.009B	Unspecified fracture of unspecified lumbar vertebra, initial encounter for open fracture
	S32.009D	Unspecified fracture of unspecified lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.009G	Unspecified fracture of unspecified lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.009K	Unspecified fracture of unspecified lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.009S	Unspecified fracture of unspecified lumbar vertebra, sequela
	S32.010A	Wedge compression fracture of first lumbar vertebra, initial encounter for closed fracture
	S32.010B	Wedge compression fracture of first lumbar vertebra, initial encounter for open fracture
	S32.010D	Wedge compression fracture of first lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.010G	Wedge compression fracture of first lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.010K	Wedge compression fracture of first lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.010S	Wedge compression fracture of first lumbar vertebra, sequela
	S32.011A	Stable burst fracture of first lumbar vertebra, initial encounter for closed fracture
	S32.011B	Stable burst fracture of first lumbar vertebra, initial encounter for open fracture
	S32.011D	Stable burst fracture of first lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.011G	Stable burst fracture of first lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.011K	Stable burst fracture of first lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.011S	Stable burst fracture of first lumbar vertebra, sequela
	S32.012A	Unstable burst fracture of first lumbar vertebra, initial encounter for closed fracture
	S32.012B	Unstable burst fracture of first lumbar vertebra, initial encounter for open fracture
	S32.012D	Unstable burst fracture of first lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.012G	Unstable burst fracture of first lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.012K	Unstable burst fracture of first lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.012S	Unstable burst fracture of first lumbar vertebra, sequela
	S32.018A	Other fracture of first lumbar vertebra, initial encounter for closed fracture
	S32.018B	Other fracture of first lumbar vertebra, initial encounter for open fracture
	S32.018D	Other fracture of first lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.018G	Other fracture of first lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.018K	Other fracture of first lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.018S	Other fracture of first lumbar vertebra, sequela

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.019A	Unspecified fracture of first lumbar vertebra, initial encounter for closed fracture
	S32.019B	Unspecified fracture of first lumbar vertebra, initial encounter for open fracture
	S32.019D	Unspecified fracture of first lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.019G	Unspecified fracture of first lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.019K	Unspecified fracture of first lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.019S	Unspecified fracture of first lumbar vertebra, sequela
	S32.020A	Wedge compression fracture of second lumbar vertebra, initial encounter for closed fracture
	S32.020B	Wedge compression fracture of second lumbar vertebra, initial encounter for open fracture
	S32.020D	Wedge compression fracture of second lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.020G	Wedge compression fracture of second lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.020K	Wedge compression fracture of second lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.020S	Wedge compression fracture of second lumbar vertebra, sequela
	S32.021A	Stable burst fracture of second lumbar vertebra, initial encounter for closed fracture
	S32.021B	Stable burst fracture of second lumbar vertebra, initial encounter for open fracture
	S32.021D	Stable burst fracture of second lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.021G	Stable burst fracture of second lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.021K	Stable burst fracture of second lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.021S	Stable burst fracture of second lumbar vertebra, sequela
	S32.022A	Unstable burst fracture of second lumbar vertebra, initial encounter for closed fracture
	S32.022B	Unstable burst fracture of second lumbar vertebra, initial encounter for open fracture
	S32.022D	Unstable burst fracture of second lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.022G	Unstable burst fracture of second lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.022K	Unstable burst fracture of second lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.022S	Unstable burst fracture of second lumbar vertebra, sequela
	S32.028A	Other fracture of second lumbar vertebra, initial encounter for closed fracture
	S32.028B	Other fracture of second lumbar vertebra, initial encounter for open fracture
	S32.028D	Other fracture of second lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.028G	Other fracture of second lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.028K	Other fracture of second lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.028S	Other fracture of second lumbar vertebra, sequela
	S32.029A	Unspecified fracture of second lumbar vertebra, initial encounter for closed fracture
	S32.029B	Unspecified fracture of second lumbar vertebra, initial encounter for open fracture
	S32.029D	Unspecified fracture of second lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.029G	Unspecified fracture of second lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.029K	Unspecified fracture of second lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.029S	Unspecified fracture of second lumbar vertebra, sequela
	S32.030A	Wedge compression fracture of third lumbar vertebra, initial encounter for closed fracture
	S32.030B	Wedge compression fracture of third lumbar vertebra, initial encounter for open fracture
	S32.030D	Wedge compression fracture of third lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.030G	Wedge compression fracture of third lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.030K	Wedge compression fracture of third lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.030S	Wedge compression fracture of third lumbar vertebra, sequela
	S32.031A	Stable burst fracture of third lumbar vertebra, initial encounter for closed fracture

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.031B	Stable burst fracture of third lumbar vertebra, initial encounter for open fracture
	S32.031D	Stable burst fracture of third lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.031G	Stable burst fracture of third lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.031K	Stable burst fracture of third lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.031S	Stable burst fracture of third lumbar vertebra, sequela
	S32.032A	Unstable burst fracture of third lumbar vertebra, initial encounter for closed fracture
	S32.032B	Unstable burst fracture of third lumbar vertebra, initial encounter for open fracture
	S32.032D	Unstable burst fracture of third lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.032G	Unstable burst fracture of third lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.032K	Unstable burst fracture of third lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.032S	Unstable burst fracture of third lumbar vertebra, sequela
	S32.038A	Other fracture of third lumbar vertebra, initial encounter for closed fracture
	S32.038B	Other fracture of third lumbar vertebra, initial encounter for open fracture
	S32.038D	Other fracture of third lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.038G	Other fracture of third lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.038K	Other fracture of third lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.038S	Other fracture of third lumbar vertebra, sequela
	S32.039A	Unspecified fracture of third lumbar vertebra, initial encounter for closed fracture
	S32.039B	Unspecified fracture of third lumbar vertebra, initial encounter for open fracture
	S32.039D	Unspecified fracture of third lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.039G	Unspecified fracture of third lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.039K	Unspecified fracture of third lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.039S	Unspecified fracture of third lumbar vertebra, sequela
	S32.040A	Wedge compression fracture of fourth lumbar vertebra, initial encounter for closed fracture
	S32.040B	Wedge compression fracture of fourth lumbar vertebra, initial encounter for open fracture
	S32.040D	Wedge compression fracture of fourth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.040G	Wedge compression fracture of fourth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.040K	Wedge compression fracture of fourth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.040S	Wedge compression fracture of fourth lumbar vertebra, sequela
	S32.041A	Stable burst fracture of fourth lumbar vertebra, initial encounter for closed fracture
	S32.041B	Stable burst fracture of fourth lumbar vertebra, initial encounter for open fracture
	S32.041D	Stable burst fracture of fourth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.041G	Stable burst fracture of fourth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.041K	Stable burst fracture of fourth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.041S	Stable burst fracture of fourth lumbar vertebra, sequela
	S32.042A	Unstable burst fracture of fourth lumbar vertebra, initial encounter for closed fracture
	S32.042B	Unstable burst fracture of fourth lumbar vertebra, initial encounter for open fracture
	S32.042D	Unstable burst fracture of fourth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.042G	Unstable burst fracture of fourth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.042K	Unstable burst fracture of fourth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.042S	Unstable burst fracture of fourth lumbar vertebra, sequela
	S32.048A	Other fracture of fourth lumbar vertebra, initial encounter for closed fracture
	S32.048B	Other fracture of fourth lumbar vertebra, initial encounter for open fracture



Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.048D	Other fracture of fourth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.048G	Other fracture of fourth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.048K	Other fracture of fourth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.048S	Other fracture of fourth lumbar vertebra, sequela
	S32.049A	Unspecified fracture of fourth lumbar vertebra, initial encounter for closed fracture
	S32.049B	Unspecified fracture of fourth lumbar vertebra, initial encounter for open fracture
	S32.049D	Unspecified fracture of fourth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.049G	Unspecified fracture of fourth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.049K	Unspecified fracture of fourth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.049S	Unspecified fracture of fourth lumbar vertebra, sequela
	S32.050A	Wedge compression fracture of fifth lumbar vertebra, initial encounter for closed fracture
	S32.050B	Wedge compression fracture of fifth lumbar vertebra, initial encounter for open fracture
	S32.050D	Wedge compression fracture of fifth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.050G	Wedge compression fracture of fifth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.050K	Wedge compression fracture of fifth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.050S	Wedge compression fracture of fifth lumbar vertebra, sequela
	S32.051A	Stable burst fracture of fifth lumbar vertebra, initial encounter for closed fracture
	S32.051B	Stable burst fracture of fifth lumbar vertebra, initial encounter for open fracture
	S32.051D	Stable burst fracture of fifth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.051G	Stable burst fracture of fifth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.051K	Stable burst fracture of fifth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.051S	Stable burst fracture of fifth lumbar vertebra, sequela
	S32.052A	Unstable burst fracture of fifth lumbar vertebra, initial encounter for closed fracture
	S32.052B	Unstable burst fracture of fifth lumbar vertebra, initial encounter for open fracture
	S32.052D	Unstable burst fracture of fifth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.052G	Unstable burst fracture of fifth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.052K	Unstable burst fracture of fifth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.052S	Unstable burst fracture of fifth lumbar vertebra, sequela
	S32.058A	Other fracture of fifth lumbar vertebra, initial encounter for closed fracture
	S32.058B	Other fracture of fifth lumbar vertebra, initial encounter for open fracture
	S32.058D	Other fracture of fifth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.058G	Other fracture of fifth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.058K	Other fracture of fifth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.058S	Other fracture of fifth lumbar vertebra, sequela
	S32.059A	Unspecified fracture of fifth lumbar vertebra, initial encounter for closed fracture
	S32.059B	Unspecified fracture of fifth lumbar vertebra, initial encounter for open fracture
	S32.059D	Unspecified fracture of fifth lumbar vertebra, subsequent encounter for fracture with routine healing
	S32.059G	Unspecified fracture of fifth lumbar vertebra, subsequent encounter for fracture with delayed healing
	S32.059K	Unspecified fracture of fifth lumbar vertebra, subsequent encounter for fracture with nonunion
	S32.059S	Unspecified fracture of fifth lumbar vertebra, sequela
	S32.10XA	Unspecified fracture of sacrum, initial encounter for closed fracture
	S32.10XB	Unspecified fracture of sacrum, initial encounter for open fracture
	S32.10XD	Unspecified fracture of sacrum, subsequent encounter for fracture with routine healing

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.10XG	Unspecified fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.10XK	Unspecified fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.10XS	Unspecified fracture of sacrum, sequela
	S32.110A	Nondisplaced Zone I fracture of sacrum, initial encounter for closed fracture
	S32.110B	Nondisplaced Zone I fracture of sacrum, initial encounter for open fracture
	S32.110D	Nondisplaced Zone I fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.110G	Nondisplaced Zone I fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.110K	Nondisplaced Zone I fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.110S	Nondisplaced Zone I fracture of sacrum, sequela
	S32.111A	Minimally displaced Zone I fracture of sacrum, initial encounter for closed fracture
	S32.111B	Minimally displaced Zone I fracture of sacrum, initial encounter for open fracture
	S32.111D	Minimally displaced Zone I fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.111G	Minimally displaced Zone I fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.111K	Minimally displaced Zone I fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.111S	Minimally displaced Zone I fracture of sacrum, sequela
	S32.112A	Severely displaced Zone I fracture of sacrum, initial encounter for closed fracture
	S32.112B	Severely displaced Zone I fracture of sacrum, initial encounter for open fracture
	S32.112D	Severely displaced Zone I fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.112G	Severely displaced Zone I fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.112K	Severely displaced Zone I fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.112S	Severely displaced Zone I fracture of sacrum, sequela
	S32.119A	Unspecified Zone I fracture of sacrum, initial encounter for closed fracture
	S32.119B	Unspecified Zone I fracture of sacrum, initial encounter for open fracture
	S32.119D	Unspecified Zone I fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.119G	Unspecified Zone I fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.119K	Unspecified Zone I fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.119S	Unspecified Zone I fracture of sacrum, sequela
	S32.120A	Nondisplaced Zone II fracture of sacrum, initial encounter for closed fracture
	S32.120B	Nondisplaced Zone II fracture of sacrum, initial encounter for open fracture
	S32.120D	Nondisplaced Zone II fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.120G	Nondisplaced Zone II fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.120K	Nondisplaced Zone II fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.120S	Nondisplaced Zone II fracture of sacrum, sequela
	S32.121A	Minimally displaced Zone II fracture of sacrum, initial encounter for closed fracture
	S32.121B	Minimally displaced Zone II fracture of sacrum, initial encounter for open fracture
	S32.121D	Minimally displaced Zone II fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.121G	Minimally displaced Zone II fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.121K	Minimally displaced Zone II fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.121S	Minimally displaced Zone II fracture of sacrum, sequela
	S32.122A	Severely displaced Zone II fracture of sacrum, initial encounter for closed fracture
	S32.122B	Severely displaced Zone II fracture of sacrum, initial encounter for open fracture
	S32.122D	Severely displaced Zone II fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.122G	Severely displaced Zone II fracture of sacrum, subsequent encounter for fracture with delayed healing

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.122K	Severely displaced Zone II fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.122S	Severely displaced Zone II fracture of sacrum, sequela
	S32.129A	Unspecified Zone II fracture of sacrum, initial encounter for closed fracture
	S32.129B	Unspecified Zone II fracture of sacrum, initial encounter for open fracture
	S32.129D	Unspecified Zone II fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.129G	Unspecified Zone II fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.129K	Unspecified Zone II fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.129S	Unspecified Zone II fracture of sacrum, sequela
	S32.130A	Nondisplaced Zone III fracture of sacrum, initial encounter for closed fracture
	S32.130B	Nondisplaced Zone III fracture of sacrum, initial encounter for open fracture
	S32.130D	Nondisplaced Zone III fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.130G	Nondisplaced Zone III fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.130K	Nondisplaced Zone III fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.130S	Nondisplaced Zone III fracture of sacrum, sequela
	S32.131A	Minimally displaced Zone III fracture of sacrum, initial encounter for closed fracture
	S32.131B	Minimally displaced Zone III fracture of sacrum, initial encounter for open fracture
	S32.131D	Minimally displaced Zone III fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.131G	Minimally displaced Zone III fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.131K	Minimally displaced Zone III fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.131S	Minimally displaced Zone III fracture of sacrum, sequela
	S32.132A	Severely displaced Zone III fracture of sacrum, initial encounter for closed fracture
	S32.132B	Severely displaced Zone III fracture of sacrum, initial encounter for open fracture
	S32.132D	Severely displaced Zone III fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.132G	Severely displaced Zone III fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.132K	Severely displaced Zone III fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.132S	Severely displaced Zone III fracture of sacrum, sequela
	S32.139A	Unspecified Zone III fracture of sacrum, initial encounter for closed fracture
	S32.139B	Unspecified Zone III fracture of sacrum, initial encounter for open fracture
	S32.139D	Unspecified Zone III fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.139G	Unspecified Zone III fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.139K	Unspecified Zone III fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.139S	Unspecified Zone III fracture of sacrum, sequela
	S32.14XA	Type 1 fracture of sacrum, initial encounter for closed fracture
	S32.14XB	Type 1 fracture of sacrum, initial encounter for open fracture
	S32.14XD	Type 1 fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.14XG	Type 1 fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.14XK	Type 1 fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.14XS	Type 1 fracture of sacrum, sequela
	S32.15XA	Type 2 fracture of sacrum, initial encounter for closed fracture
	S32.15XB	Type 2 fracture of sacrum, initial encounter for open fracture
	S32.15XD	Type 2 fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.15XG	Type 2 fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.15XK	Type 2 fracture of sacrum, subsequent encounter for fracture with nonunion

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S32.15XS	Type 2 fracture of sacrum, sequela
	S32.16XA	Type 3 fracture of sacrum, initial encounter for closed fracture
	S32.16XB	Type 3 fracture of sacrum, initial encounter for open fracture
	S32.16XD	Type 3 fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.16XG	Type 3 fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.16XK	Type 3 fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.16XS	Type 3 fracture of sacrum, sequela
	S32.17XA	Type 4 fracture of sacrum, initial encounter for closed fracture
	S32.17XB	Type 4 fracture of sacrum, initial encounter for open fracture
	S32.17XD	Type 4 fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.17XG	Type 4 fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.17XK	Type 4 fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.17XS	Type 4 fracture of sacrum, sequela
	S32.19XA	Other fracture of sacrum, initial encounter for closed fracture
	S32.19XB	Other fracture of sacrum, initial encounter for open fracture
	S32.19XD	Other fracture of sacrum, subsequent encounter for fracture with routine healing
	S32.19XG	Other fracture of sacrum, subsequent encounter for fracture with delayed healing
	S32.19XK	Other fracture of sacrum, subsequent encounter for fracture with nonunion
	S32.19XS	Other fracture of sacrum, sequela
	S32.2XXA	Fracture of coccyx, initial encounter for closed fracture
	S32.2XXB	Fracture of coccyx, initial encounter for open fracture
	S32.2XXD	Fracture of coccyx, subsequent encounter for fracture with routine healing
	S32.2XXG	Fracture of coccyx, subsequent encounter for fracture with delayed healing
	S32.2XXK	Fracture of coccyx, subsequent encounter for fracture with nonunion
	S32.2XXS	Fracture of coccyx, sequela
	S33.0XXA	Traumatic rupture of lumbar intervertebral disc, initial encounter
	S33.0XXD	Traumatic rupture of lumbar intervertebral disc, subsequent encounter
	S33.0XXS	Traumatic rupture of lumbar intervertebral disc, sequela
	S33.100A	Subluxation of unspecified lumbar vertebra, initial encounter
	S33.100D	Subluxation of unspecified lumbar vertebra, subsequent encounter
	S33.100S	Subluxation of unspecified lumbar vertebra, sequela
	S33.101A	Dislocation of unspecified lumbar vertebra, initial encounter
	S33.101D	Dislocation of unspecified lumbar vertebra, subsequent encounter
	S33.101S	Dislocation of unspecified lumbar vertebra, sequela
	S33.110A	Subluxation of L1/L2 lumbar vertebra, initial encounter
	S33.110D	Subluxation of L1/L2 lumbar vertebra, subsequent encounter
	S33.110S	Subluxation of L1/L2 lumbar vertebra, sequela
	S33.111A	Dislocation of L1/L2 lumbar vertebra, initial encounter
	S33.111D	Dislocation of L1/L2 lumbar vertebra, subsequent encounter
	S33.111S	Dislocation of L1/L2 lumbar vertebra, sequela
	S33.120A	Subluxation of L2/L3 lumbar vertebra, initial encounter
	S33.120D	Subluxation of L2/L3 lumbar vertebra, subsequent encounter
	S33.120S	Subluxation of L2/L3 lumbar vertebra, sequela

Appendix Table 1 (continued). *Codes list for patient selection pain diagnosis and all pain symptoms and conditions.*

Inclusion/ Exclusion	Code	Description (pain diagnosis)
	S33.121A	Dislocation of L2/L3 lumbar vertebra, initial encounter
	S33.121D	Dislocation of L2/L3 lumbar vertebra, subsequent encounter
	S33.121S	Dislocation of L2/L3 lumbar vertebra, sequela
	S33.130A	Subluxation of L3/L4 lumbar vertebra, initial encounter
	S33.130D	Subluxation of L3/L4 lumbar vertebra, subsequent encounter
	S33.130S	Subluxation of L3/L4 lumbar vertebra, sequela
	S33.131A	Dislocation of L3/L4 lumbar vertebra, initial encounter
	S33.131D	Dislocation of L3/L4 lumbar vertebra, subsequent encounter
	S33.131S	Dislocation of L3/L4 lumbar vertebra, sequela
	S33.140A	Subluxation of L4/L5 lumbar vertebra, initial encounter
	S33.140D	Subluxation of L4/L5 lumbar vertebra, subsequent encounter
	S33.140S	Subluxation of L4/L5 lumbar vertebra, sequela
	S33.141A	Dislocation of L4/L5 lumbar vertebra, initial encounter
	S33.141D	Dislocation of L4/L5 lumbar vertebra, subsequent encounter
	S33.141S	Dislocation of L4/L5 lumbar vertebra, sequela
	S33.2XXA	Dislocation of sacroiliac and sacrococcygeal joint, initial encounter
	S33.2XXD	Dislocation of sacroiliac and sacrococcygeal joint, subsequent encounter
	S33.2XXS	Dislocation of sacroiliac and sacrococcygeal joint, sequela

Appendix Table 2. *Codes list for neurological deficits.*

Inclusion/ Exclusion	Code	Description
	M21.371	Other acquired deformities of limbs, foot drop right foot
	M21.372	Other acquired deformities of limbs, foot drop left foot
	M21.379	Foot drop, unspecified foot
	G83.4	Cauda equina syndrome
	G95.89	Other specified diseases of spinal cord
	M47.011	Anterior spinal artery compression syndromes, occipito-atlanto-axial region
	M47.012	Anterior spinal artery compression syndromes, cervical region
	M47.013	Anterior spinal artery compression syndromes, cervicothoracic region
	M47.014	Anterior spinal artery compression syndromes, thoracic region
	M47.015	Anterior spinal artery compression syndromes, thoracolumbar region
	M47.016	Anterior spinal artery compression syndromes, lumbar region
	M47.019	Anterior spinal artery compression syndromes, site unspecified
	M47.021	Vertebral artery compression syndromes, occipito-atlanto-axial region
	M47.022	Vertebral artery compression syndromes, cervical region
	M47.029	Vertebral artery compression syndromes, site unspecified
	M47.10	Other spondylosis with myelopathy, site unspecified
	M47.11	Other spondylosis with myelopathy, occipito-atlanto-axial region
	M47.12	Other spondylosis with myelopathy, cervical region
	M47.13	Other spondylosis with myelopathy, cervicothoracic region
	M47.14	Other spondylosis with myelopathy, thoracic region
	M47.15	Other spondylosis with myelopathy, thoracolumbar region
	M47.16	Other spondylosis with myelopathy, lumbar region
	M50.00	Cervical disc disorder with myelopathy, unspecified cervical region
	M50.01	Cervical disc disorder with myelopathy, high cervical region
	M50.020	Cervical disc disorder with myelopathy, mid-cervical region, unspecified level
	M50.021	Cervical disc disorder at C4-C5 level with myelopathy
	M50.022	Cervical disc disorder at C5-C6 level with myelopathy
	M50.023	Cervical disc disorder at C6-C7 level with myelopathy
	M50.03	Cervical disc disorder with myelopathy, cervicothoracic region
	M51.04	Intervertebral disc disorders with myelopathy, thoracic region
	M51.05	Intervertebral disc disorders with myelopathy, thoracolumbar region
	M51.06	Intervertebral disc disorders with myelopathy, lumbar region
	N31.0	Uninhibited neuropathic bladder, not elsewhere classified
	N31.1	Reflex neuropathic bladder, not elsewhere classified
	N31.2	Flaccid neuropathic bladder, not elsewhere classified
	N31.8	Other neuromuscular dysfunction of bladder
	N31.9	Neuromuscular dysfunction of bladder, unspecified

