

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods

Outcome Ascertainment using Electronic Medical Record Data

In each of the two health systems, we used EpicCare EMR data to ascertain primary and secondary imaging outcomes among actual patients of study clinicians. We assessed imaging outcomes during a post-intervention period of up to 18 months after the final intervention SPI visit (or a randomly selected “pseudo-intervention” date among control clinicians). We also assessed imaging outcomes during a 24-month pre-intervention period (prior to the date of randomization) to enable adjustment for clinicians’ baseline propensity to order imaging and to allow assessment for pre-to-post-intervention changes in imaging rates. Depending on the date of clinician randomization, the pre-intervention period ranged from March 22, 2019 to August 5, 2021, and the post-intervention period ranged from October 28, 2021 to May 31, 2023.

Patient visits included both in-person and telemedicine visits (with telemedicine visits identified using Healthcare Common Procedure Coding System codes G2010, G2012, G2061-2063; Current Procedural Terminology codes 99421-99423, 99431, 99441-99443; 99201-99215 with a GT-95 modifier). Consistent with the National Committee for Quality Assurance overuse measure related to low back pain imaging,¹ we used International Classification of Diseases (ICD)-10-Clinical Modification (CM) diagnosis codes to identify patients aged 18-90 years presenting with acute or new-onset back pain based on the absence of back pain diagnoses on visits in the prior six months and the inclusion of a back pain diagnostic code in the primary position on the claims (eTable 2). We also collected patient age and sex to allow adjustment for patient characteristics and restriction of analyses to patients aged 18-65 years consistent with the NCQA measure. Analogously, we identified pre- and post-intervention visits for acute neck pain based on ICD-10-CM codes for neck pain (eTable 3). Consistent with the NCQA measure,¹ we excluded patients with high-risk conditions that would justify spinal imaging by using diagnostic, procedural, and filled prescription data to identify and exclude patients with any of the following diagnoses or conditions during the study period: non-skin cancer or malignancy, human immunodeficiency virus infection, kidney or major organ transplant, osteoporosis therapy or dispensed prescription, fragility fracture, spinal infection, or 90 or more cumulative days of glucocorticoid prescriptions dispensed (eTable 4). Patients with visits who subsequently died during the study period were excluded from all imaging analyses.

Among eligible low back pain visits, we ascertained whether spinal imaging was ordered during the visit and whether it was completed within 90 days. We also assessed completion of advanced spinal imaging using Magnetic Resonance Imaging (MRI) or computed tomography (CT) within 90 days of eligible low back pain visits. We identified analogous cervical spinal imaging outcomes for patients with eligible acute neck pain visits.

Per protocol (NCT 04255199), we sought to measure the rate of overall diagnostic testing among adult patients adjusted for baseline by identifying counts of diagnostic tests ordered during primary care visits with participating clinicians during the 24-month period prior to their first SPI visits and from the date of their final SPI visits (or the “pseudo-intervention” date for control clinicians) through up to 18 months of follow-up. To facilitate this assessment, we identified the most common 500 diagnostic tests ordered during adult office visits in 2022 by primary care clinicians in one of the systems, including imaging tests, hematology and chemistry, urine and body fluid analyses, microbiology, electrocardiography, cardiac and nuclear medicine tests, but excluding tests performed for screening or prevention (e.g., lipid or diabetes mellitus tests, bilateral screening mammograms). However, due to differences in data storage at the two sites, we were not ultimately able to harmonize extractions of non-imaging tests. We therefore report only diagnostic imaging tests completed within 90 days of visits by adult patients aged 18-90 years study clinicians during the study period.

Summarizing Patient Experience Data at the Two Sites

Both health systems collected routine patient experience survey data after patient visits. However, the systems contracted with different survey vendors, and the vendors used different but comparable survey items related to the care provider.

At the first health system, five survey items pertained to the care provider: the provider’s discussion of any proposed treatment (options, risks, benefits, etc.); the providers’ efforts to include (the patient) in decisions about care; the concern the provider showed for questions or worries; explanations the provider gave about problems or conditions; and the likelihood of recommending the provider to others. The health system dichotomized each item as “top-box” or not based on whether the patient rated the provider at the highest response category on the item, and then summarized the provider performance on the visit as an average of the item ratings after assigning 100 points for each item that was top-box and 0 points for each item that was not top-box.

At the second health system, three survey items pertained to the care provider: whether the provider explained things clearly; whether the provider listened carefully; and the overall provider rating (from 0-10). Response options to the first two items were “yes, definitely,” “yes, mostly,” “yes, somewhat,” and “no.” To mirror the approach of the first health system, we assigned analogous top-box ratings for the three items (with 9 or 10 considered top-box for provider rating) and created a summary scale ranging from 0-100.

Within each system, we performed item-test and item-rest correlations and found that individual items had consistently high correlations with the summary scale. Using data within each system separately, we performed factor analyses that showed that the scale items loaded onto a single underlying factor. Cronbach’s alpha for the summary scales were high within both health systems ($\alpha=0.95$ in the first health system and 0.79 in the second health system). Based on these results, we concluded that the summary scale at each site likely reflected the same underlying construct (“patient experience with the provider”), so opted to pool the summary measures from the two sites in the analysis.

During the study period, the two systems received 21,799 responses to patient experience surveys after visits with study clinicians, including 6,868 (31.5%) in the pre-intervention period, 14,931 in the post-intervention period (68.5%), and 267 (1.2%) after visits with acute low back pain.

eTable 1. Intervention Model with Key Skills and Criteria for Fulfillment

| Step | Key Skills | Criteria for fulfillment with examples (to guide intervention content and coding) |
|--|--|---|
| 1. Set the stage for deferred imaging by building trust | <ol style="list-style-type: none"> 1. Demonstrate openness and interest 2. Avoid interruptions 3. Identify the patient's motivating concern or expectations | <ol style="list-style-type: none"> 1. Non-verbal openness and engagement <ul style="list-style-type: none"> • Sits, orients toward the patient • Maintains open body position, leans in • Frequent, attentive eye contact • Engaged facial expressions or gestures (e.g., nodding) 2. Clinician doesn't interrupt early on. Allows patient to "tell their story" without cutting them off. 3. Clinician probes or asks for more information when patient signals a major underlying or motivating concern or expectations: "It sounds like you're worried that you seriously injured your back. Is that right?" or "You seem to be concerned that you need an MRI. Can you tell me more about that?" |
| 2. Convey empathy | <ol style="list-style-type: none"> 1. Legitimize patient's concerns 2. Name and explore patient's emotions 3. Express your understanding 4. Make supportive statements 5. Praise patient's attempts to address pain | <ol style="list-style-type: none"> 1. Legitimizing statements: "I can understand why you're concerned." 2. Naming and exploring emotions: "You said you're afraid. Can you tell me more about what you're afraid of?" 3. Expressing understanding: "This obviously a tough thing to go through. I can see that it's really impacted your work life." 4. Supportive statements: "I'm committed to helping you find a workable solution." 5. Praise: "I think it's great that you've been trying to get out and walk." |
| 3. Communicate optimism and openness while advocating a plan without imaging | <ol style="list-style-type: none"> 1. Convey <i>optimism</i> when sharing your assessment and suggested plan, emphasizing reassuring aspects of the history and physical examination and the patient's favorable prognosis. 2. Advocate a conservative treatment plan without imaging 3. If patient asks about imaging, recommend a watchful waiting approach 4. Communicate your <i>availability</i> if the patient's pain doesn't improve. | <ol style="list-style-type: none"> 1. Frames diagnosis and treatment recommendation in an optimistic, positive frame: "Overall, I'm actually quite reassured by your history and physical. I don't see any signs of a disc problem or nerve involvement, and I'm confident that your back pain is very likely to improve markedly over the next couple of weeks." 2. Confidently endorses an initial treatment plan that does not include imaging EX: "Given your reassuring history and exam, I'm confident that you'll improve with conservative treatment, and in these cases, I don't recommend imaging at this time." 3. If patient asks about imaging, clinician advocates a "watchful waiting" approach: EX: "I don't recommend imaging at this point, but I'd consider it in a few weeks if your pain didn't improve substantially, as I expect it to." 4. Articulates a follow-up, contingency plan for what the patient should do if the pain or other symptoms worsen or do not improve. Plan should address <i>how</i> the patient should contact the clinician, <i>when</i> they should do so, and <i>what</i> the clinician is likely to do in response. (The follow-up plan may or may not include a plan for deferred imaging.) EX: "If your pain is not substantially improved within two weeks, I'd like you to contact me via MyChart. I can then order you an x-ray and then we can have a either a phone call or a video visit." |

eFigure 1. Figure Shared with Clinicians During Intervention Visits

(Front)

Strategies for Watchful Waiting To Avoid Inappropriate Testing (WAIT)



1. SET THE STAGE FOR DEFERRED IMAGING BY BUILDING TRUST

- Demonstrate openness and interest
- Avoid interruptions
- Identify the patient's motivating concerns or expectations.

2. CONVEY EMPATHY

- Legitimize patient's concerns
- Name and explore patient's emotions
- Express your understanding
- Praise patient's attempts to address pain



3. COMMUNICATE OPTIMISM WHILE ADVOCATING A PLAN WITHOUT IMAGING

- Convey optimism when sharing your assessment and plan.
- Advocate a conservative treatment plan without imaging.
- Connect your recommendations to the patient's motivating concerns.
- Recommend a Watchful Waiting approach if patient asks about imaging.
- Communicate your availability in case the patient doesn't improve.



IMAGING IS NOT NEEDED FOR:

1. Younger patients (<65 years old) with low back pain less than six weeks duration
2. Patients without RED FLAG features (cancer history, weight loss, fever, loss of control of bowel or bladder, strength or sensory loss in legs or saddle)

(Back)

Example Communication Strategies

STEP 1

SET THE STAGE FOR DEFERRED IMAGING BY BUILDING TRUST

Ask about underlying concerns and expectations:

1. “You seem really worried about your pain. Tell me what worries you most.”
2. “You seem to be concerned that you need an MRI. Can you tell me more about that?”

STEP 2

CONVEY EMPATHY

1. **Legitimizing statements:** “I can understand why you’re concerned.”
2. **Name and explore emotions:** “You said you’re afraid. Can you tell me more about what you’re afraid of?”
3. **Express understanding:** “This is a tough thing to go through. I can see it’s really impacted your work life.”
4. **Praise:** “I think it’s great that you’ve been trying to get out and walk.”

STEP 3

COMMUNICATE OPTIMISM WHILE ADVOCATING A PLAN WITHOUT IMAGING

1. **Optimistic framing of conservative treatment plan:** “Overall, I’m actually quite reassured by your history and physical. I don’t see any signs of a disc problem or nerve involvement, and I’m confident that your back pain is very likely to improve markedly over the next couple of weeks with PT or perhaps a muscle relaxant.”
2. **Connect treatment plan to patient’s concerns:** “You expressed concerns about work. Gentle exercise and stretching will help maintain your back strength and flexibility so you can gradually get back to your normal daily activities and work.”
3. **Employ Watchful Waiting:** “I don’t recommend imaging at this point but I’d consider it in a few weeks if your pain didn’t improve substantially, as I expect it to.”
4. **Follow-up contingency plan:** “If your pain is not substantially improved within two weeks, I’d like you to contact me via MyChart. I can then order you an x-ray and we can have a either a phone call or a video visit.”

eTable 2. ICD-10-CM Codes for Lower Back Pain

| ICD-10-CM | ICD-10-CM Description |
|------------------|---|
| M4305 | Spondylolysis, thoracolumbar region |
| M4306 | Spondylolysis, lumbar region |
| M4307 | Spondylolysis, lumbosacral region |
| M4308 | Spondylolysis, sacral and sacrococcygeal region |
| M4309 | Spondylolysis, multiple sites in spine |
| M4315 | Spondylolisthesis, thoracolumbar region |
| M4316 | Spondylolisthesis, lumbar region |
| M4317 | Spondylolisthesis, lumbosacral region |
| M4318 | Spondylolisthesis, sacral and sacrococcygeal region |
| M4319 | Spondylolisthesis, multiple sites in spine |
| M4605 | Spinal enthesopathy, thoracolumbar region |
| M4606 | Spinal enthesopathy, lumbar region |
| M4607 | Spinal enthesopathy, lumbosacral region |
| M4608 | Spinal enthesopathy, sacral and sacrococcygeal region |
| M4609 | Spinal enthesopathy, multiple sites in spine |
| M4715 | Other spondylosis with myelopathy, thoracolumbar region |
| M4716 | Other spondylosis with myelopathy, lumbar region |
| M4725 | Other spondylosis with radiculopathy, thoracolumbar region |
| M4726 | Other spondylosis with radiculopathy, lumbar region |
| M4727 | Other spondylosis with radiculopathy, lumbosacral region |
| M4728 | Other spondylosis with radiculopathy, sacral and sacrococcygeal region |
| M47815 | Spondylosis without myelopathy or radiculopathy, thoracolumbar region |
| M47816 | Spondylosis without myelopathy or radiculopathy, lumbar region |
| M47817 | Spondylosis without myelopathy or radiculopathy, lumbosacral region |
| M47818 | Spondylosis without myelopathy or radiculopathy, sacral and sacrococcygeal region |
| M47895 | Other spondylosis, thoracolumbar region |
| M47896 | Other spondylosis, lumbar region |
| M47897 | Other spondylosis, lumbosacral region |
| M47898 | Other spondylosis, sacral and sacrococcygeal region |
| M4805 | Spinal stenosis, thoracolumbar region |
| M48061 | Spinal stenosis, lumbar region without neurogenic claudication |
| M48062 | Spinal stenosis, lumbar region with neurogenic claudication |
| M4807 | Spinal stenosis, lumbosacral region |
| M4808 | Spinal stenosis, sacral and sacrococcygeal region |
| M488X5 | Other specified spondylopathies, thoracolumbar region |
| M488X6 | Other specified spondylopathies, lumbar region |
| M488X7 | Other specified spondylopathies, lumbosacral region |
| M488X8 | Other specified spondylopathies, sacral and sacrococcygeal region |
| M4985 | Spondylopathy in diseases classified elsewhere, thoracolumbar region |
| M4986 | Spondylopathy in diseases classified elsewhere, lumbar region |
| M4987 | Spondylopathy in diseases classified elsewhere, lumbosacral region |

M4988 Spondylopathy in diseases classified elsewhere, sacral and sacrococcygeal region
M4989 Spondylopathy in diseases classified elsewhere, multiple sites in spine
M5105 Intervertebral disc disorders with myelopathy, thoracolumbar region
M5106 Intervertebral disc disorders with myelopathy, lumbar region
M5115 Intervertebral disc disorders with radiculopathy, thoracolumbar region
M5116 Intervertebral disc disorders with radiculopathy, lumbar region
M5117 Intervertebral disc disorders with radiculopathy, lumbosacral region
M5125 Other intervertebral disc displacement, thoracolumbar region
M5126 Other intervertebral disc displacement, lumbar region
M5127 Other intervertebral disc displacement, lumbosacral region
M5134 Other intervertebral disc degeneration, thoracic region
M5135 Other intervertebral disc degeneration, thoracolumbar region
M5136 Other intervertebral disc degeneration, lumbar region
M5137 Other intervertebral disc degeneration, lumbosacral region
M5145 Schmorl's nodes, thoracolumbar region
M5146 Schmorl's nodes, lumbar region
M5147 Schmorl's nodes, lumbosacral region
M5185 Other intervertebral disc disorders, thoracolumbar region
M5186 Other intervertebral disc disorders, lumbar region
M5187 Other intervertebral disc disorders, lumbosacral region
M519 Unspecified thoracic, thoracolumbar and lumbosacral intervertebral disc disorder
M533 Sacrococcygeal disorders, not elsewhere classified
M5385 Other specified dorsopathies, thoracolumbar region
M5386 Other specified dorsopathies, lumbar region
M5387 Other specified dorsopathies, lumbosacral region
M5388 Other specified dorsopathies, sacral and sacrococcygeal region
M5415 Radiculopathy, thoracolumbar region
M5416 Radiculopathy, lumbar region
M5417 Radiculopathy, lumbosacral region
M5418 Radiculopathy, sacral and sacrococcygeal region
M5430 Sciatica, unspecified side
M5431 Sciatica, right side
M5432 Sciatica, left side
M5440 Lumbago with sciatica, unspecified side
M5441 Lumbago with sciatica, right side
M5442 Lumbago with sciatica, left side
M545 Low back pain
M5489 Other dorsalgia
M9903 Segmental and somatic dysfunction of lumbar region
M9904 Segmental and somatic dysfunction of sacral region
M9905 Segmental and somatic dysfunction of pelvic region
M9913 Subluxation complex (vertebral) of lumbar region
M9914 Subluxation complex (vertebral) of sacral region
M9915 Subluxation complex (vertebral) of pelvic region

M9923 Subluxation stenosis of neural canal of lumbar region
M9924 Subluxation stenosis of neural canal of sacral region
M9925 Subluxation stenosis of neural canal of pelvic region
M9932 Osseous stenosis of neural canal of thoracic region
M9933 Osseous stenosis of neural canal of lumbar region
M9934 Osseous stenosis of neural canal of sacral region
M9935 Osseous stenosis of neural canal of pelvic region
M9943 Connective tissue stenosis of neural canal of lumbar region
M9944 Connective tissue stenosis of neural canal of sacral region
M9945 Connective tissue stenosis of neural canal of pelvic region
M9952 Intervertebral disc stenosis of neural canal of thoracic region
M9953 Intervertebral disc stenosis of neural canal of lumbar region
M9954 Intervertebral disc stenosis of neural canal of sacral region
M9955 Intervertebral disc stenosis of neural canal of pelvic region
M9963 Osseous and subluxation stenosis of intervertebral foramina of lumbar region
M9964 Osseous and subluxation stenosis of intervertebral foramina of sacral region
M9965 Osseous and subluxation stenosis of intervertebral foramina of pelvic region
M9972 Connective tissue and disc stenosis of intervertebral foramina of thoracic region
M9973 Connective tissue and disc stenosis of intervertebral foramina of lumbar region
M9974 Connective tissue and disc stenosis of intervertebral foramina of sacral region
M9975 Connective tissue and disc stenosis of intervertebral foramina of pelvic region
M9983 Other biomechanical lesions of lumbar region
M9984 Other biomechanical lesions of sacral region
M9985 Other biomechanical lesions of pelvic region
S330XXA Traumatic rupture of lumbar intervertebral disc, initial encounter
S33100A Subluxation of unspecified lumbar vertebra, initial encounter
S33110A Subluxation of L1/L2 lumbar vertebra, initial encounter
S33120A Subluxation of L2/L3 lumbar vertebra, initial encounter
S33130A Subluxation of L3/L4 lumbar vertebra, initial encounter
S33140A Subluxation of L4/L5 lumbar vertebra, initial encounter
S335XXA Sprain of ligaments of lumbar spine, initial encounter
S336XXA Sprain of sacroiliac joint, initial encounter
S338XXA Sprain of other parts of lumbar spine and pelvis, initial encounter
S339XXA Sprain of unspecified parts of lumbar spine and pelvis, initial encounter
S3421XA Injury of nerve root of lumbar spine, initial encounter
S3422XA Injury of nerve root of sacral spine, initial encounter
S344XXA Injury of lumbosacral plexus, initial encounter
S39002A Unspecified injury of muscle, fascia and tendon of lower back, initial encounter
S39012A Strain of muscle, fascia and tendon of lower back, initial encounter
S39092A Other injury of muscle, fascia and tendon of lower back, initial encounter
S3982XA Other specified injuries of lower back, initial encounter
S3992XA Unspecified injury of lower back, initial encounter

eTable 3. Neck Pain Diagnosis Codes

| ICD-10-CM | ICD-10-CM Description |
|-----------|--|
| M4301 | Spondylolysis, occipito-atlanto-axial region |
| M4302 | Spondylolysis, cervical region |
| M4303 | Spondylolysis, cervicothoracic region |
| M4311 | Spondylolisthesis, occipito-atlanto-axial region |
| M4312 | Spondylolisthesis, cervical region |
| M4313 | Spondylolisthesis, cervicothoracic region |
| M436 | Torticollis |
| M4601 | Spinal enthesopathy, occipito-atlanto-axial region |
| M4602 | Spinal enthesopathy, cervical region |
| M4603 | Spinal enthesopathy, cervicothoracic region |
| M4711 | Other spondylosis with myelopathy, occipito-atlanto-axial region |
| M4712 | Other spondylosis with myelopathy, cervical region |
| M4713 | Other spondylosis with myelopathy, cervicothoracic region |
| M4721 | Other spondylosis with radiculopathy, occipito-atlanto-axial region |
| M4722 | Other spondylosis with radiculopathy, cervical region |
| M4723 | Other spondylosis with radiculopathy, cervicothoracic region |
| M47811 | Spondylosis without myelopathy or radiculopathy, occipito-atlanto-axial region |
| M47812 | Spondylosis w/o myelopathy or radiculopathy, cervical region |
| M47813 | Spondylosis without myelopathy or radiculopathy, cervicothoracic region |
| M47891 | Other spondylosis, occipito-atlanto-axial region |
| M47892 | Other spondylosis, cervical region |
| M47893 | Other spondylosis, cervicothoracic region |
| M4801 | Spinal stenosis, occipito-atlanto-axial region |
| M4802 | Spinal stenosis, cervical region |
| M4803 | Spinal stenosis, cervicothoracic region |
| M488X1 | Other specified spondylopathies, occipito-atlanto-axial region |
| M488X2 | Other specified spondylopathies, cervical region |
| M488X3 | Other specified spondylopathies, cervicothoracic region |
| M4981 | Spondylopathy in diseases classified elsewhere, occipito-atlanto-axial region |
| M4982 | Spondylopathy in diseases classified elsewhere, cervical region |
| M4983 | Spondylopathy in diseases classified elsewhere, cervicothoracic region |
| M5000 | Cervical disc disorder with myelopathy, unsp cervical region |
| M5001 | Cervical disc disorder with myelopathy, high cervical region |
| M50020 | Cervical disc disorder with myelopathy, mid-cervical region, unspecified level |
| M50021 | Cervical disc disorder at C4-C5 level with myelopathy |
| M50022 | Cervical disc disorder at C5-C6 level with myelopathy |
| M50023 | Cervical disc disorder at C6-C7 level with myelopathy |
| M5003 | Cervical disc disorder with myelopathy, cervicothoracic region |
| M5010 | Cervical disc disorder with radiculopathy, unspecified cervical region |
| M5011 | Cervical disc disorder with radiculopathy, high cervical region |
| M50120 | Mid-cervical disc disorder, unspecified level |

| | |
|--------|--|
| M50121 | Cervical disc disorder at C4-C5 level with radiculopathy |
| M50122 | Cervical disc disorder at C5-C6 level with radiculopathy |
| M50123 | Cervical disc disorder at C6-C7 level with radiculopathy |
| M5013 | Cervical disc disorder with radiculopathy, cervicothoracic region |
| M5020 | Other cervical disc displacement, unsp cervical region |
| M5021 | Other cervical disc displacement, high cervical region |
| M50220 | Other cervical disc displacement, mid-cervical region, unspecified level |
| M50221 | Other cervical disc displacement at C4-C5 level |
| M50222 | Other cervical disc displacement at C5-C6 level |
| M50223 | Other cervical disc displacement at C6-C7 level |
| M5023 | Other cervical disc displacement, cervicothoracic region |
| M5030 | Other cervical disc degeneration, unsp cervical region |
| M5031 | Other cervical disc degeneration, high cervical region |
| M50320 | Other cervical disc degeneration, mid-cervical region, unspecified level |
| M50321 | Other cervical disc degeneration at C4-C5 level |
| M50322 | Other cervical disc degeneration at C5-C6 level |
| M50323 | Other cervical disc degeneration at C6-C7 level |
| M5033 | Other cervical disc degeneration, cervicothoracic region |
| M5080 | Other cervical disc disorders, unspecified cervical region |
| M5081 | Other cervical disc disorders, high cervical region |
| M50820 | Other cervical disc disorders, mid-cervical region, unspecified level |
| M50821 | Other cervical disc disorders at C4-C5 level |
| M50822 | Other cervical disc disorders at C5-C6 level |
| M50823 | Other cervical disc disorders at C6-C7 level |
| M5083 | Other cervical disc disorders, cervicothoracic region |
| M5090 | Cervical disc disorder, unsp, unspecified cervical region |
| M5091 | Cervical disc disorder, unspecified, high cervical region |
| M50920 | Unspecified cervical disc disorder, mid-cervical region, unspecified level |
| M50921 | Unspecified cervical disc disorder at C4-C5 level |
| M50922 | Unspecified cervical disc disorder at C5-C6 level |
| M50923 | Unspecified cervical disc disorder at C6-C7 level |
| M5093 | Cervical disc disorder, unspecified, cervicothoracic region |
| M530 | Cervicocranial syndrome |
| M531 | Cervicobrachial syndrome |
| M5381 | Other specified dorsopathies, occipito-atlanto-axial region |
| M5382 | Other specified dorsopathies, cervical region |
| M5383 | Other specified dorsopathies, cervicothoracic region |
| M5411 | Radiculopathy, occipito-atlanto-axial region |
| M5412 | Radiculopathy, cervical region |
| M5413 | Radiculopathy, cervicothoracic region |
| M542 | Cervicalgia |
| M5481 | Occipital neuralgia |
| M9900 | Segmental and somatic dysfunction of head region |
| M9901 | Segmental and somatic dysfunction of cervical region |

| | |
|---------|--|
| M9910 | Subluxation complex (vertebral) of head region |
| M9911 | Subluxation complex (vertebral) of cervical region |
| M9920 | Subluxation stenosis of neural canal of head region |
| M9921 | Subluxation stenosis of neural canal of cervical region |
| M9930 | Osseous stenosis of neural canal of head region |
| M9931 | Osseous stenosis of neural canal of cervical region |
| M9940 | Connective tissue stenosis of neural canal of head region |
| M9941 | Connective tissue stenosis of neural canal of cervical region |
| M9950 | Intervertebral disc stenosis of neural canal of head region |
| M9951 | Intervertebral disc stenosis of neural canal of cervical region |
| M9960 | Osseous and subluxation stenosis of intervertebral foramina of head region |
| M9961 | Osseous and subluxation stenosis of intervertebral foramina of cervical region |
| M9970 | Connective tissue and disc stenosis of intervertebral foramina of head region |
| M9971 | Connective tissue and disc stenosis of intervertebral foramina of cervical region |
| M9980 | Other biomechanical lesions of head region |
| M9981 | Other biomechanical lesions of cervical region |
| S130XXA | Traumatic rupture of cervical intervertebral disc, initial encounter |
| S13100A | Subluxation of unspecified cervical vertebrae, initial encounter |
| S13110A | Subluxation of C0/C1 cervical vertebrae, initial encounter |
| S13120A | Subluxation of C1/C2 cervical vertebrae, initial encounter |
| S13130A | Subluxation of C2/C3 cervical vertebrae, initial encounter |
| S13140A | Subluxation of C3/C4 cervical vertebrae, initial encounter |
| S13150A | Subluxation of C4/C5 cervical vertebrae, initial encounter |
| S13160A | Subluxation of C5/C6 cervical vertebrae, initial encounter |
| S13170A | Subluxation of C6/C7 cervical vertebrae, initial encounter |
| S13180A | Subluxation of C7/T1 cervical vertebrae, initial encounter |
| S134XXA | Sprain of ligaments of cervical spine, initial encounter |
| S138XXA | Sprain of joints and ligaments of other parts of neck, initial encounter |
| S139XXA | Sprain of joints and ligaments of unspecified parts of neck, initial encounter |
| S142XXA | Injury of nerve root of cervical spine, initial encounter |
| S143XXA | Injury of brachial plexus, initial encounter |
| S161XXA | Strain of muscle, fascia and tendon at neck level, initial encounter |
| S168XXA | Other specified injury of muscle, fascia and tendon at neck level, initial encounter |
| S169XXA | Unspecified injury of muscle, fascia and tendon at neck level, initial encounter |
| S1980XA | Other specified injuries of unspecified part of neck, initial encounter |
| S1989XA | Other specified injuries of other specified part of neck, initial encounter |
| S199XXA | Unspecified injury of neck, initial encounter |

eTable 4. Other Exclusions for Back or Neck Pain Imaging Measure

| Diagnosis/Condition | Diagnostic or Other Codes (ICD-10-CM, HCPCS, etc.) |
|--|---|
| Non-skin cancer or malignancy | <p>C00.0-C00.6, C00.8, C00.9, C01, C02.0-C02.4, C02.8, C02.9, C03.0, C03.1, C03.9, C04.0, C04.1, C04.8, C04.9, C05.0, C05.1, C05.2, C05.8, C05.9, C06.0, C06.1, C06.2, C06.80, C06.89, C06.9, C07, C08.0, C08.1, C08.9, C09.0, C09.1, C09.8, C09.9, C10.0- C10.4, C10.8, C10.9, C11.0-C11.3, C11.8, C11.9, C12, C13.0, C13.1, C13.2, C13.8, C13.9, C14.0, C14.2, C14.8, C15.3, C15.4, C15.5, C15.8, C15.9, C16.0-C16.6, C16.8, C16.9, C17.0-C17.3, C17.8, C17.9, C18.0-C18.9, C19, C20, C21.0; C44.00-C44.02; C92.60, C93.92, C93.Z0, C93.Z1, C93.Z2, C94.00, C94.01, C94.02, C94.20, C94.21, C94.22, C94.30, C94.31, C94.32, C94.40, C94.41, C94.42, C94.6, C94.80, C94.81, C94.82, C95.00, C95.01, C95.02, C95.10, C95.11, C95.12, C95.90, C95.91, C95.92 C96.0, C96.2, C96.20, C96.21, C96.22, C96.29, C96.4, C96.5, C96.6, C96.9, C96.A, C96.Z;</p> <p>D00.00- D00.08, D00.1, D00.2, D01.0- D01.3, D01.40, D01.49, D01.5, D01.7, D01.9, D02.0, D02.1, D02.20-D02.22, D02.3, D02.4, D03.0, D03.10, D03.11, D03.111, D03.112, D03.121, D03.122, D03.20, D03.21, D03.22, D03.30, D03.39, D03.4, D03.51, D03.52, D03.59, D03.60, D03.61, D03.62, D03.70, D03.71, D03.72, D03.8, D03.9, D04.0, D04.10, D04.11, D04.111, D04.112, D04.12, D04.121, D04.122, D04.20, D04.21, D04.22, D04.30, D04.39, D04.4, D04.5, D04.60, D04.61, D04.62, D04.70, D04.71, D04.72, D04.8, D04.9, D05.00, D05.01, D05.02, D05.10, D05.11, D05.12, D05.80, D05.81, D05.82, D05.90, D05.91, D05.92, D06.0, D06.1, D06.7, D06.9, D07.0, D07.1, D07.2, D07.30, D07.39, D07.4, D07.5, D07.60, D07.61, D07.69, D09.0, D09.10, D09.19, D09.20, D09.21, D09.22, D09.3, D09.8, D09.9, D37.01, D37.02, D37.030, D37.031, D37.032, D37.039, D37.04, D37.05, D37.09, D37.1- D37.6, D37.8, D37.9, D38.0-D38.6, D39.0, D39.10, D39.11, D39.12, D39.2, D39.8, D39.9, D40.0, D40.10, D40.11, D40.12, D40.8, D40.9, D41.00, D41.01, D41.02, D41.10, D41.11, D41.12, D41.20, D41.21, D41.22, D41.3, D41.4, D41.8, D41.9, D42.0, D42.1, D42.9, D43.0-D43.4, D43.8, D43.9, D44.0, D44.10, D44.11, D44.12, D44.2-D44.7, D44.9, D45, D46.0, D46.1, D46.20, D46.21, D46.22, D46.4, D46.9, D46.A, D46.B, D46.C, D46.Z, D47.0, D47.01, D47.02, D47.09-D47.4, D47.9, D47.Z1, D47.Z2, D47.Z9, D48.0-D48.5, D48.60, D48.61, D48.62, D48.7, D48.9, D49.0, D49.1, D49.2, D49.3, D49.4, D49.5, D49.511, D49.512, D49.519, D49.59, D49.6, D49.7, D49.81, D49.89, D49.9</p> <p>Z85.00, Z85.01, Z85.020</p> |
| HIV | B20, Z21 |
| Kidney / Major organ transplant | <p>History of Kidney Transplant: ICD-10-CM: Z94.0 Kidney Transplant: CPT: 50360, 50365, 50380,</p> <ul style="list-style-type: none"> ▪ HCPCS: S2065 ▪ ICD-10-PCS: 0TY00Z0, 0TY00Z1, 0TY00Z2, 0TY10Z0, 0TY10Z1, 0TY10Z2 <p>○ Organ Transplant Other Than Kidney:</p> <ul style="list-style-type: none"> ▪ CPT : 32850, 32851, 32852, 32853, 32854, 32855, 32856 |
| Osteoporosis therapy or a dispensed prescription to treat osteoporosis | <ul style="list-style-type: none"> ▪ HCPCS: <ul style="list-style-type: none"> ▪ J0897 Injection, denosumab, 1 mg ▪ J1740 Injection, ibandronate sodium, 1 mg ▪ J3110 Injection, teriparatide, 10 mcg ▪ J3111 Injection, romosozumab-aqqg, 1 mg |

| | |
|---------------------------|---|
| | <ul style="list-style-type: none"> ▪ J3489 Injection, zoledronic acid, 1 mg <p>Any prescriptions for:</p> <ul style="list-style-type: none"> • Alendronate • Alendronate-cholecalciferol • Ibandronate • Risedronate • Zoledronic Acid • Abaloparatide • Denosumab • Raloxifene • Romosozumab • Teriparatide |
| Fragility fracture | ICD-10-CM: M48.40XA, M48.40XD, M48.40XG, M48.40XS, M48.41XA, M48.41XD, M48.41XG, M48.41XS, M48.42XA, M48.42XD, M48.42XG, M48.42XS, M48.43XA, M48.43XD, M48.43XG, M48.43XS, M48.44XA, M48.44XD, M48.44XG, M48.44XS, M48.45XA, M48.45XD, M48.45XG, M48.45XS, M48.46XA, M48.46XD, M48.46XG, M48.46XS, M48.47XA, M48.47XD, M48.47XG, M48.47XS, M48.48XA, M48.48XD, M48.48XG, M48.48XS, M80.08XA, M80.08XD, M80.08XG, M80.08XK, M80.08XP, M80.08XS, M80.88XA, M80.88XD, M80.88XG, M80.88XK, M80.88XP, M80.88XS, M84.359A, M84.359D, M84.359G, M84.359K, M84.359P, M84.359S, M97.01XA, M97.01XD, M97.01XS, M97.02XA, M97.02XD, M97.02XS |
| Spinal infection | A17.81, G06.1, M46.25-M46.28, M46.35-M46.38, M46.46-M46.48 |
| Prolonged corticosteroids | <p>During the entire study period, exclude patients with 90 or more consecutive days' supplied with one of the following oral drugs:</p> <ul style="list-style-type: none"> • Hydrocortisone • Cortisone • Prednisone • Prednisolone • Methylprednisolone • Triamcinolone • Dexamethasone • Betamethasone |

eTable 5. Clinician Satisfaction With Standardized Patient Instructor Training (n=22 intervention clinicians)*

| Item | Mean rating (SD)[†] | Range |
|---|-------------------------------------|--------------|
| Overall quality of training | 1.4 (0.6) | 1-3 |
| Easy to understand | 1.2 (0.4) | 1-2 |
| Would recommend to other doctors | 1.7 (0.7) | 1-3 |
| Watchful waiting training relevant to my practice | 1.3 (0.5) | 1-2 |
| Training helped me provide better care to my patients | 1.9 (0.9) | 1-4 |
| Training improved my communication with patients | 1.7 (0.9) | 1-4 |

*22 of 25 intervention clinicians responded to the post-trial survey (88%).

[†]Response range for each item was: 1=Strongly agree, 2=Agree, 3=Neither agree nor disagree, 4=Disagree, 5=Strongly disagree

eTable 6. Posttrial Attitudes and Use of Watchful Waiting by Study Arm

| Item | Intervention (n=22) Mean (SD)* | Control (n=27) Mean (SD)* | p-value [†] |
|---|-----------------------------------|------------------------------|----------------------|
| Watchful waiting is my preferred approach for most patients with low back pain | 1.4 (0.5) | 1.5 (0.6) | 0.49 |
| I use watchful waiting more often now than before study | 2.2 (1.1) | 3.0 (0.9) | 0.005 |
| I feel confident using watchful waiting for patients with low back pain | 1.3 (0.5) | 1.6 (0.6) | 0.045 |
| I know how to address concerns when patients are reluctant about watchful waiting | 1.5 (0.5) | 1.8 (0.4) | 0.019 |
| I believe patients are less satisfied with a watchful waiting approach | 3.1 (1.1) | 2.9 (0.9) | 0.41 |

*22 of 25 intervention clinicians (88%) and 27 of 28 control clinicians (96%) responded to the post-trial survey. Response range for each item was: 1=Strongly agree, 2=Agree, 3=Neither agree nor disagree, 4=Disagree, 5=Strongly disagree

[†] T-test comparing means from intervention and control groups.

eReferences

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2. Gerrity MS, DeVellis RF, Earp JA. Physicians' reactions to uncertainty in patient care. A new measure and new insights. *Med Care*. 1990;28(8):724-736.