This bibliography contains the full literature search results for each question (see Step 7 in the Guideline Development Process). Work group members reviewed all abstracts yielded from the literature search and identified the literature to review in order to address the clinical questions (see Step 8 in the Guideline Development Process). The references that were ultimately used to answer each clinical question can be found in the main text of the Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care: Diagnosis and Treatment of Low Back Pain.

### Bibliography

**Diagnosis**

- Imaging
- Medical and Psychological Treatment
- Physical Medicine & Rehabilitation
- Interventional
- Surgical
- Cost Utility

#### Diagnosis

**Diagnosis Question 1:** In patients with low back pain, are there specific history or physical examination findings that would indicate the structure causing pain and, therefore, guide treatment?

- a. Vertebral body
- b. Intervertebral disc
- c. Zygapophyseal joint
- d. Posterior elements
- e. Sacroiliac joint
- f. Muscle/tendon
- g. Central sensitization

**Diagnosis Question 2:** In patients with low-back pain, are there history or physical examination findings that would serve as predictors for the recurrence of low-back pain?

**Diagnosis Question 3:** In patients with acute low-back pain, are there history or physical examination findings that would predict that an episode will resolve within one month?

**Diagnosis Question 4:** In patients with low-back pain, what history and/or physical examination findings are useful in determining if the cause is non-structural in nature and, therefore, guide treatment?

**Diagnosis Question 5:** In patients with low-back pain, what elements of the patient’s history and findings from the physical examination would suggest the need for diagnostic laboratory studies?
Diagnosis Question 6: What are the patient characteristics that increase or decrease the risk of developing chronic low-back pain after an acute episode? | 224
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Diagnosis Question 7: In patients with low-back pain, are there specific findings on a pain diagram that help differentiate the structure which is causing pain? | 234
Diagnosis Question 8: Are there assessment tools or questionnaires that can help identify the cause of acute, subacute or chronic low back pain? | 
Diagnosis Question 9: Does a psychological evaluation assist with identifying patients with low back pain who are at risk for developing chronic pain or disability? | 267
Diagnosis Question 10: Are there history and physical examination findings that would warrant obtaining advanced imaging studies? | 274
<table>
<thead>
<tr>
<th>Imaging Question 1: What is the association between low back pain and spondylosis on routine radiography?</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging Question 2: Is there evidence to support the use of computed tomography (CT) or magnetic resonance imaging (MRI) for the evaluation of low back pain in the absence of x-ray/radiographic abnormality?</td>
<td>310</td>
</tr>
<tr>
<td>Imaging Question 3: In patients with low back pain, does duration of symptoms correlate with abnormal findings on imaging?</td>
<td>333</td>
</tr>
</tbody>
</table>
| Imaging Question 4: What is the optimal imaging protocol that should be used in the setting of low back pain?  
  a. Are unique MRI sequences considered preferential or optimal?  
  b. What is the history and clinical presentation that suggests the use of contrast enhanced imaging in patients with low back pain?  
  c. Is there evidence to support imaging the lumbar spine in an oblique plane?  
  d. What is the value of flexion/extension films in evaluating lower back pain? | 406  |
<p>| Imaging Question 5: In the absence of red flags, what are the imaging (x-ray, CT or MRI) recommendations for patients with acute or chronic low back pain? | 425  |
| Imaging Question 6: Are there imaging findings that correlate with the presence of low back pain? | 452  |
| Imaging Question 7: Are there imaging findings that contribute to decision making by healthcare providers to guide treatment? | 470  |
| Imaging Question 8: What is the value of PET/CT in the evaluation of low back pain? | 543  |</p>
<table>
<thead>
<tr>
<th>Medical and Psychological Treatment</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med/Psych Question 1: Is smoking cessation effective in decreasing the frequency of low back pain episodes?</td>
<td>562</td>
</tr>
<tr>
<td>Med/Psych Question 2: In patients with low back pain, is pharmacological treatment effective in decreasing duration of pain, decreasing intensity of pain, increasing functional outcomes of treatment and improving the return to work rate? Versus: a. No treatment i. Risks ii. Complications b. Cognitive behavioral therapy (CBT) and/or psychosocial intervention alone c. Patient education alone</td>
<td>563</td>
</tr>
<tr>
<td>Med/Psych Question 3: In patients with low back pain, is topical treatment (e.g. cream or gel) effective in decreasing duration of pain, decreasing intensity of pain, increasing functional outcomes of treatment and improving the return to work rate?</td>
<td>722</td>
</tr>
<tr>
<td>Med/Psych Question 4: Following treatment for low back pain, do patients with healthy sleep habits experience decreased duration of pain, decreased intensity of pain, increased functional outcomes and improved return to work rates compared to patients with poor sleeping habits?</td>
<td>738</td>
</tr>
<tr>
<td>Med/Psych Question 5: In patients with low back pain, is cognitive behavioral therapy (CBT) and/or psychosocial intervention and/or neuroscience education effective in decreasing duration of pain, decreasing intensity of pain, increasing functional outcomes, decreasing anxiety and/or depression and improving return to work rate?</td>
<td>746</td>
</tr>
<tr>
<td>Med/Psych Question 6: In patients with low-back pain, does the timing of cognitive behavioral therapy (CBT) and/or psychosocial intervention and/or neuroscience education affect duration of pain, intensity of pain, functional outcomes, anxiety, depression and return to work status?</td>
<td>797</td>
</tr>
<tr>
<td>Med/Psych Question 7: In patients undergoing interventional or surgical treatment for low back pain, does the addition of cognitive behavioral therapy (CBT) and/or psychosocial intervention add incremental benefit?</td>
<td>849</td>
</tr>
<tr>
<td>Med/Psych Question 8: Does educating a patient about low back pain improve treatment compliance and outcomes, including duration of pain, intensity of pain, functional outcomes, anxiety, depression and return to work status?</td>
<td>879</td>
</tr>
<tr>
<td>Med/Psych Question 9: In patients undergoing treatment for low back pain, what is the effectiveness of interventions that address fear avoidance behaviors?</td>
<td>899</td>
</tr>
<tr>
<td>Med/Psych Question 10: Is active treatment (pharmacological or psychotherapeutic) of anxiety and depression effective in decreasing low back pain?</td>
<td>927</td>
</tr>
<tr>
<td>Med/Psych Question 11: What are the psychological factors influencing outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, of low back pain treatment?</td>
<td>940</td>
</tr>
<tr>
<td>Med/Psych Question 12: In patients with low back pain, what psychosocial/cognitive/emotional or other assessments should be utilized to establish an accurate diagnosis?</td>
<td>986</td>
</tr>
<tr>
<td>Med/Psych Question 13: Does nutrition (other than weight reduction) influence the frequency of low back pain episodes?</td>
<td>986</td>
</tr>
</tbody>
</table>
**Physical Medicine & Rehabilitation**

<table>
<thead>
<tr>
<th>PM&amp;R Question</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In patients undergoing treatment for low back pain, what is the effectiveness of the following in decreasing the duration of pain, decreasing intensity of pain, increasing functional outcomes and improving return to work status, as compared with natural history plus or minus medication:</td>
<td>995</td>
</tr>
<tr>
<td>2. In patients undergoing treatment for low back pain, what is the appropriate timing, frequency and duration of treatment with:</td>
<td></td>
</tr>
<tr>
<td>a. Acute versus subacute versus chronic</td>
<td></td>
</tr>
<tr>
<td>i. Patient education and self-directed exercise program</td>
<td></td>
</tr>
<tr>
<td>ii. Physical agents (eg, heat, cold, ultrasound, electrical stimulation, laser, dry needling, traction, TENS)</td>
<td></td>
</tr>
<tr>
<td>iii. Acupuncture</td>
<td></td>
</tr>
<tr>
<td>iv. Bracing</td>
<td></td>
</tr>
<tr>
<td>• Lumbosacral brace</td>
<td></td>
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<tr>
<td>• Sacroiliac brace</td>
<td></td>
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<tr>
<td>v. Spinal manipulative therapy (SMT)</td>
<td></td>
</tr>
<tr>
<td>vi. Exercise/physical therapy versus or plus massage</td>
<td></td>
</tr>
<tr>
<td>vii. Active stabilization exercise</td>
<td></td>
</tr>
<tr>
<td>viii. McKenzie exercise (includes directional preference, centralization, and mechanical diagnosis and therapy (MDT)</td>
<td></td>
</tr>
<tr>
<td>ix. Yoga</td>
<td></td>
</tr>
<tr>
<td>x. Aerobic exercise</td>
<td></td>
</tr>
<tr>
<td>xi. Work hardening or conditioning</td>
<td></td>
</tr>
<tr>
<td>PM&amp;R Question 3: Are there specific patient or treatment characteristics that predict improved duration of pain, intensity of pain, functional outcomes and return to work status with SMT following an episode of low back pain?</td>
<td>1117</td>
</tr>
<tr>
<td>PM&amp;R Question 4: In patients undergoing treatment for low back pain, what are outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, for exercise therapy alone versus exercise with cognitive behavioral therapy (CBT)?</td>
<td>1146</td>
</tr>
<tr>
<td>PM&amp;R Question 5: In patients undergoing treatment for low back pain, what are outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, for a lumbar stabilization exercise program versus a general fitness program?</td>
<td>1171</td>
</tr>
<tr>
<td>PM&amp;R Question 6: In patients undergoing treatment for low back pain, what are outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, for SMT versus SMT plus active exercise?</td>
<td>1175</td>
</tr>
<tr>
<td>PM&amp;R Question 7: In patients undergoing treatment for low back pain, what are the outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, for bed rest versus active exercise?</td>
<td>1201</td>
</tr>
<tr>
<td>PM&amp;R Question 8: In patients with low back pain, does a regular exercise program (or pre-surgical intervention with exercise, PT, education) prior to lumbar surgery decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate compared to those who don't exercise?</td>
<td>1212</td>
</tr>
<tr>
<td>PM&amp;R Question 9: In patients with low back pain, does exercise treatment after epidural steroid injections/spinal interventions decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate compared to injections alone?</td>
<td>1247</td>
</tr>
<tr>
<td>PM&amp;R Question 10: Following surgery for low back pain, are outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, improved with a formal exercise/rehabilitation program versus home instruction plus or minus self-directed exercise program alone?</td>
<td>1254</td>
</tr>
<tr>
<td>PM&amp;R Question 11: Can a clinical prediction rule determine appropriate indications and predict outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, for exercise for low back pain?</td>
<td>1279</td>
</tr>
</tbody>
</table>
**Interventional Treatment**

<table>
<thead>
<tr>
<th>Interventional Question</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interventional Question 1: In patients with low-back pain, do fluoroscopically-guided epidural steroid injections decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?</td>
<td>1283</td>
</tr>
</tbody>
</table>
| Interventional Question 2: When evaluating fluoroscopically guided intra-articular lumbar facet joint injections in patients with acute or chronic low-back pain:  
  a. What is the diagnostic utility of this procedure?  
  b. From a therapeutic standpoint, does this procedure decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate? | 1287 |
| Interventional Question 3: In patients with low-back pain, do medial branch blocks have a role in defining treatment for low-back pain?  
  a. Does duration of pain, intensity of pain, functional outcomes and return to work status vary when candidates for neurotomy are determined by single vs comparative medial branch blocks?  
  b. Is there a threshold for the magnitude of relief from diagnostic facet nerve blocks that predict outcomes to neurotomy?  
  c. Does duration of pain, intensity of pain, functional outcomes and return to work status vary when candidates for neurotomy are determined by diagnostic facet nerve blocks vs. intra-articular facet joint injections?  
  d. Is there a therapeutic utility of medial branch blocks?  
  e. Does technical accuracy of medial branch blocks (e.g. contrast use) affects its validity and effectiveness of subsequent neurotomy? | 1291 |
| Interventional Question 4: In patients with low-back pain due to lumbar facet joint arthropathy, does fluoroscopically guided neurotomy decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate? | 1329 |
| Interventional Question 5: In patients with low-back pain, do fluoroscopically guided sacroiliac joint injections (SIJI) decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?  
  a. Does duration of pain, intensity of pain, functional outcomes and return to work status vary when candidates for neurotomy are determined by single vs. comparative SIJI?  
  b. Is there a benefit to performing lateral branch blocks as compared with interarticular diagnostic injections as a predictor to response to lateral branch neurotomy?  
  c. Is there a threshold for the magnitude of relief from diagnostic SIJI that predict improvement in duration of pain, intensity of pain, functional outcomes and return to work status from SIJ neurotomy? | 1335 |
| Interventional Question 6: In patients with pelvic posterior girdle pain relieved temporarily by image guided SIJ injections or lateral branch blocks, does lateral branch neurotomy decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate? | 1372 |
| Interventional Question 7: In patients with low-back pain, does spinal cord stimulation decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate? | 1277 |
| Interventional Question 8: In patients with low-back pain, does continuous delivery of intrathecal opioids decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate and are there risks associated with its use? | 1437 |
| Interventional Question 9: In patients with low back pain, is provocative lumbar discography more accurate than other diagnostic modalities in identifying the disc as a source of pain? | 1459 |
| Interventional Question 10: In patients with low back pain, is anesthetic lumbar discography more accurate than other diagnostic modalities in identifying the disc as a source of pain? | 1472 |
| Interventional Question 11: In patients with low-back pain, does intradiscal injection decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate? | 1473 |
Interventional Question 12: In patients with low-back pain, does intradiscal electrothermal therapy or biaculoplasty decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?

Interventional Question 13: In patients with low-back pain, do trigger point injections decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?
Surgical Treatment

Surgical Question 1: In patients with low back pain, does surgical treatment vs. medical/interventional treatment alone decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?

Surgical Question 2: In patients with low back pain, are there predictive factors which determine the benefit of initial treatment with surgical intervention versus initial medical/interventional treatment?

Surgical Question 3: In patients undergoing fusion surgery for low back pain, which fusion technique results in the best outcomes for the following: decreased duration of pain, decreased intensity of pain, increased functional outcomes of treatment and improved return to work rate?
  a. Posterolateral fusion without internal fixation vs.
  b. Posterolateral transverse fusion with internal fixation vs.
  c. Stand-alone (anterior) interbody fusion vs.
  d. Transforaminal lumbar interbody fusion (TLIF) or posterior lumbar interbody fusion (PLIF) vs.
  e. Circumferential fusion (anterior interbody, lateral techniques)

Surgical Question 4: In patients undergoing fusion surgery for low back pain, are clinical outcomes, including duration of pain, intensity of pain, functional outcomes and return to work status, different for multi-level fusions vs. single level fusions?

Surgical Question 5: In patients undergoing fusion surgery for low back pain, does radiographic evidence of fusion correlate with decreased duration of pain, decreased intensity of pain, increased functional outcomes of treatment and improved return to work rate?

Surgical Question 6: In patients undergoing fusion surgery for low back pain, does the use of bone growth stimulators (vs. fusion alone) decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?

Surgical Question 7: In patients undergoing fusion surgery for low back pain, does the use of BMP (vs. fusion alone) decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?

Surgical Question 8: In patients undergoing fusion surgery for low back pain, does the use of minimally invasive techniques decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate compared to open fusion techniques?

Surgical Question 9: In patients undergoing surgery for low back pain, do motion preserving systems (disc prosthesis and dynamic stabilization systems treatment) decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate compared to fusion surgery?

Surgical Question 10: In patients undergoing surgery for low back pain, do motion preserving systems (disc prosthesis and dynamic stabilization systems) result in lower incidence of symptomatic adjacent segment disease?

Surgical Question 11: In patients with low back pain, does fusion treatment decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate compared to treatment with:
  a. Discectomy
  b. Discectomy plus rhizotomy
  c. Decompression alone

Surgical Question 12: In patients with low back pain due to sacroiliac joint dysfunction, does sacroiliac joint fusion compared with medical/interventional treatment decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?
## Cost-Utility

<table>
<thead>
<tr>
<th>Cost Utility Question 1: What is the most cost-effective spinal care provider for evaluating patients with low back pain:</th>
<th>1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Chiropractor vs.</td>
<td></td>
</tr>
<tr>
<td>b. Physical Therapist vs.</td>
<td></td>
</tr>
<tr>
<td>c. Primary Care Provider (including non-physician providers) vs.</td>
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<tr>
<td>d. Neurologist vs.</td>
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</tr>
<tr>
<td>e. Physiatrist vs.</td>
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</tr>
<tr>
<td>f. Spine Surgeon vs.</td>
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<tr>
<td>g. Anesthesiologists/Pain medicine Physician vs.</td>
<td></td>
</tr>
<tr>
<td>h. Radiologist</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost Utility Question 2. What is the cost-utility of diagnostic imaging studies/workup in the evaluation of low back pain (acute, subacute, and chronic), in terms of influencing/altering treatment or in terms of leading to pain reduction and functional improvement?</th>
<th>1945</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. X-rays (lumbar standing, lumbar flexion-extension, entire spine)</td>
<td></td>
</tr>
<tr>
<td>b. CT scan / CT myelogram</td>
<td></td>
</tr>
<tr>
<td>c. MRI (conventional or dynamic/upright/weight bearing)</td>
<td></td>
</tr>
</tbody>
</table>

| Cost Utility Question 3. Does the use of ordering physician owned diagnostic and treatment facilities affect the cost of low back pain related healthcare services? | 2025 |

| Cost Utility Question 4. Are epidural steroid injections (including interlaminar, transforminal, and caudal injections and selective nerve root blocks) more cost effective in the management of patients with low back pain than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 5. Is spinal cord stimulation more cost effective in the management of patients with low back pain than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 6. Is physical therapy in the management of patients with low back pain more cost effective than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 7. Is pharmacological management (over-the-counter + prescription medications) for patients with low back pain more or less cost-effective than interventional treatments including physical therapy and injection therapies? | 2041 |

| Cost Utility Question 8. Is spinal manipulative therapy in the management of patients with low back pain more cost effective than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 9. Is acupuncture-based therapy in the management of patients with low back pain more cost effective than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 10. Are over-the-counter medications only without other medical interventions more cost effective in the management of patients with low back pain than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 11. Is cognitive or psychological based therapy in the management of patients with low back pain more cost effective than other medical/interventional treatments? |  
|---|---|

| Cost Utility Question 12. In patients with low back pain, is a symptom guided treatment approach using directional preference/centralization matched exercise more cost effective than usual care (home care vs. medication vs non-specific physical therapy exercise vs non-specific physical therapy modalities) long term at 12 months, 36 months? | 1251 |

| Cost Utility Question 13. Is the surgical management (including fusion and lumbar disc replacement and spinal cord stimulators) of patients with low back pain more cost effective than medical/interventional treatments? | 2203 |

| Cost Utility Question 14. Is cognitive or psychological based therapy in the management of patients with low back pain more cost effective than surgical therapies? | 2229 |

| Cost Utility Question 15. Are minimally invasive surgical procedures more cost effective in the management of patients with low back pain than conventional open surgical procedures? | 2243 |

| Cost Utility Question 16. Is instrumented lumbar fusion more cost-effective compared to non-instrumented fusion for the treatment of patients with low back pain? | 2250 |
**DIAGNOSIS**

**Diagnosis Question 1.** In patients with low back pain, are there specific history or physical examination findings that would indicate the structure causing pain and, therefore, guide treatment?

- a. Vertebral body
- b. Intervertebral disc
- c. Zygaphyseal joint
- d. Posterior elements
- e. Sacroiliac joint
- f. Muscle/tendon
- g. Central sensitization

**Diagnosis Question 2.** In patients with low-back pain, are there history or physical examination findings that would serve as predictors for the recurrence of low-back pain?

**Diagnosis Question 3.** In patients with acute low-back pain, are there history or physical examination findings that would predict that an episode will resolve within one month?

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multifidus muscle and the iliocostalis lumborum between healthy subjects and patients with sub-

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**IMAGING**

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PHYSICAL MEDICINE & REHABILITATION

Literature search for questions 1 and 2 was combined

1. In patients undergoing treatment for low back pain, what is the effectiveness of the following in decreasing the duration of pain, decreasing intensity of pain, increasing functional outcomes and improving return to work status, as compared with natural history plus or minus medication:

2. In patients undergoing treatment for low back pain, what is the appropriate timing, frequency and duration of treatment with:
   a. Acute versus subacute versus chronic
      i. Patient education and self-directed exercise program
      ii. Physical agents (e.g., heat, cold, ultrasound, electrical stimulation, laser, dry needling, traction, TENS)
      iii. Acupuncture
      iv. Bracing
         - Lumbosacral brace
         - Sacroiliac brace
      v. Spinal manipulative therapy (SMT)
      vi. Exercise/physical therapy versus or plus massage
      vii. Active stabilization exercise
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**Interventional Question Question 2:** When evaluating fluoroscopically guided intra-articular lumbar facet joint injections in patients with acute or chronic low-back pain:

a. What is the diagnostic utility of this procedure?

b. From a therapeutic standpoint, does this procedure decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?


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**Interventional Question 3**: In patients with low-back pain, do medial branch blocks have a role in defining treatment for low-back pain?

a. Does duration of pain, intensity of pain, functional outcomes and return to work status vary when candidates for neurotomy are determined by single vs comparative medial branch blocks?

b. Is there a threshold for the magnitude of relief from diagnostic facet nerve blocks that predict outcomes to neurotomy?

c. Does duration of pain, intensity of pain, functional outcomes and return to work status vary when candidates for neurotomy are determined by diagnostic facet nerve blocks vs. intra-articular facet joint injections?

d. Is there a therapeutic utility of medial branch blocks?

e. Does technical accuracy of medial branch blocks (e.g. contrast use) affects its validity and effectiveness of subsequent neurotomy?


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Interventional Question 5: In patients with low-back pain, do fluoroscopically guided sacroiliac joint injections (SIJI) decrease the duration of pain, decrease the intensity of pain, increase the functional outcomes of treatment and improve the return to work rate?

   a. Does duration of pain, intensity of pain, functional outcomes and return to work status vary when candidates for neurotomy are determined by single vs. comparative SIJI?
   b. Is there a benefit to performing lateral branch blocks as compared with interarticular diagnostic injections as a predictor to response to lateral branch neurotomy?
   c. Is there a threshold for the magnitude of relief from diagnostic SIJI that predict improvement in duration of pain, intensity of pain, functional outcomes and return to work status from SIJ neurotomy?


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b. Posterolateral transverse fusion with internal fixation vs.
c. Stand-alone (anterior) interbody fusion vs.
d. Transforaminal lumbar interbody fusion (TLIF) or posterior lumbar interbody fusion (PLIF) vs.
e. Circumferential fusion (anterior interbody, lateral techniques

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b. **Discectomy plus rhizotomy**
c. **Decompression alone**


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COST UTILITY

Cost Utility Question 1: What is the most cost-effective spinal care provider for evaluating patients with low back pain:

a. Chiropractor vs.
b. Physical Therapist vs.
c. Primary Care Provider (including non-physician providers) vs.
d. Neurologist vs.
e. Physiatrist vs.
f. Spine Surgeon vs.
g. Anesthesiologists/Pain medicine Physician vs.
h. Radiologist


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Cost Utility Question 2: What is the cost-effectiveness of diagnostic imaging studies/workup in the evaluation of low back pain (acute, subacute, and chronic), in terms of influencing/altering treatment or in terms of leading to pain reduction and functional improvement?

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b. CT scan / CT myelogram
c. MRI (conventional or dynamic/upright/weight bearing)


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