Policy Statement

Interspinous or interlaminar distraction devices as a stand-alone procedure are considered investigational as a treatment of spinal stenosis.

Use of an interlaminar stabilization device following decompression surgery is considered investigational.

Policy Guidelines

Coding

The following CPT category I codes are specific to this procedure:

- **22867**: Insertion of interlaminar/interspinous process stabilization/distraction device, without fusion, including image guidance when performed, with open decompression, lumbar; single level
- **22868**: Insertion of interlaminar/interspinous process stabilization/distraction device, without fusion, including image guidance when performed, with open decompression, lumbar; second level (List separately in addition to code for primary procedure)
- **22869**: Insertion of interlaminar/interspinous process stabilization/distraction device, without open decompression or fusion, including image guidance when performed, lumbar; single level
- **22870**: Insertion of interlaminar/interspinous process stabilization/distraction device, without open decompression or fusion, including image guidance when performed, lumbar; second level (List separately in addition to code for primary procedure)

Prior to 2017, the following were specific CPT category III codes for this procedure:

- **0171T**: Insertion of posterior spinous process distraction device (including necessary removal of bone or ligament for insertion and imaging guidance), lumbar; single level
- **0172T**: Insertion of posterior spinous process distraction device (including necessary removal of bone or ligament for insertion and imaging guidance), lumbar; each additional level (List separately in addition to code for primary procedure)

The following is also a HCPCS "C" Medicare pass-through code for the device:

- **C1821**: Interspinous process distraction device (implantable)

Description

Interspinous and interlaminar implants (spacers) stabilize or distract the adjacent lamina and/or spinous processes and restrict extension to reduce pain in patients with lumbar spinal stenosis and neurogenic claudication. Interspinous spacers are small devices implanted between the vertebral spinous processes. After implantation, the device is opened or expanded to distract (open) the neural foramen and decompress the nerves. Interlaminar spacers are implanted midline between the adjacent lamina and spinous processes to provide dynamic stabilization either following decompression surgery or as an alternative to decompression surgery.

Related Policies

- Facet Arthroplasty
- Interspinous Fixation (Fusion) Devices
**Benefit Application**

Benefit determinations should be based in all cases on the applicable contract language. To the extent there are any conflicts between these guidelines and the contract language, the contract language will control. Please refer to the member’s contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

Some state or federal mandates (e.g., Federal Employee Program [FEP]) prohibits plans from denying Food and Drug Administration (FDA)-approved technologies as investigational. In these instances, plans may have to consider the coverage eligibility of FDA-approved technologies on the basis of medical necessity alone.

**Regulatory Status**

Three interspinous and interlaminar stabilization and distraction devices have been approved by the Food Drug Administration (FDA) through the premarket approval (FDA product code: NQO) are summarized in Table 1.

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Manufacturer</th>
<th>Approval Date</th>
<th>PMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coflex® Interlaminar Technology</td>
<td>Paradigm Spine</td>
<td>2012</td>
<td>P110008</td>
</tr>
<tr>
<td>Superion® Indirect Decompression System (previously Superion® Interspinous Spacer)</td>
<td>VertiFlex</td>
<td>2015</td>
<td>P140004</td>
</tr>
</tbody>
</table>

PMA: premarket approval.

The Superion® Indirect Decompression System (formerly InterSpinous Spacer) is indicated to treat skeletally mature patients suffering from pain, numbness, and/or cramping in the legs secondary to a diagnosis of moderate degenerative lumbar spinal stenosis, with or without grade 1 spondylothesis, confirmed by x-ray, magnetic resonance imaging, and/or computed tomography evidence of thickened ligamentum flavum, narrowed lateral recess, and/or central canal or foraminal narrowing. It is intended for patients with an impaired physical function who experience relief in flexion from symptoms of leg/buttock/groin pain, numbness, and/or cramping, with or without back pain, and who have undergone at least six months of nonoperative treatment.

The FDA lists the following contraindications to use of the Superion® Indirect Decompression System:

- An allergy to titanium or titanium alloy.
- Spinal anatomy or disease that would prevent implantation of the device or cause the device to be unstable in situ, such as:
  - Instability of the lumbar spine, e.g., isthmic spondylothesis or degenerative spondylothesis greater than grade 1 (on a scale of 1 to 4)
  - An ankylosed segment at the affected level(s)
  - Fracture of the spinous process, pars interarticularis, or laminae (unilateral or bilateral);
  - Scoliosis (Cobb angle >10 degrees)
- Cauda equina syndrome defined as neural compression causing neurogenic bladder or bowel dysfunction.
  - Diagnosis of severe osteoporosis, defined as bone mineral density (from DEXA [dual-energy x-ray absorptiometry] scan or equivalent method) in the spine or hip that is more than 2.5 S.D. below the mean of adult normal.
- Active systemic infection, or infection localized to the site of implantation.
- Prior fusion or decompression procedure at the index level.
Morbid obesity defined as a body mass index (BMI) greater than 40."

The coflex® Interlaminar Technology implant (Paradigm Spine) is a single-piece U-shaped titanium alloy dynamic stabilization device with pairs of wings that surround the superior and inferior spinous processes. The coflex® (previously called the Interspinous U) is indicated for use in 1- or 2-level lumbar stenosis from the L1 to L5 vertebrae in skeletally mature patients with at least moderate impairment in function, who experience relief in flexion from their symptoms of leg/buttocks/groin pain, with or without back pain, and who have undergone at least six months of nonoperative treatment. The coflex® "is intended to be implanted midline between the adjacent lamina of one or two contiguous lumbar motion segments. Interlaminar stabilization is performed after decompression of stenosis at the affected level(s).

The FDA lists the following contraindications to use of the coflex®:
- Prior fusion or decompressive laminectomy at any index lumbar level.
- Radiographically compromised vertebral bodies at any lumbar level(s) caused by current or past trauma or tumor (e.g., compression fracture).
- Severe facet hypertrophy that requires extensive bone removal which would cause instability.
- Grade II or greater spondylolisthesis.
- Isthmic spondylolisthesis or spondylolysis (pars fracture).
- Degenerative lumbar scoliosis (Cobb angle greater than 25°).
- Osteoporosis.
- Back or leg pain of unknown etiology.
- Axial back pain only, with no leg, buttock, or groin pain.
- Morbid obesity defined as a body mass index > 40.
- Active or chronic infection - systemic or local.
- Known allergy to titanium alloys or MR [magnetic resonance] contrast agents.
  - Cauda equina syndrome defined as neural compression causing neurogenic bowel or bladder dysfunction."

The FDA labeling also contains multiple precautions and the following warning: "Data has demonstrated that spinous process fractures can occur with coflex® implantation."

At the time of approval, the FDA requested additional postmarketing studies to provide longer-term device performance and device performance under general conditions of use. The first was the five-year follow-up of the pivotal investigational device exemption trial. The second was a multicenter trial with 230 patients in Germany who were followed for 5 years, comparing decompression alone with decompression plus coflex®. The third, a multicenter trial with 345 patients in the U.S. who were followed for 5 years, compared decompression alone with decompression plus coflex®.27, FDA product code: NQO.

**Rationale**

**Background**

**Spinal Stenosis**

Lumbar spinal stenosis (LSS), which affects over 200,000 people in the U.S., involves a narrowed central spinal canal, lateral spinal recesses, and/or neural foramina, resulting in pain as well as limitation of activities such as walking, traveling, and standing. In adults over 60 in the U.S., spondylosis (degenerative arthritis affecting the spine) is the most common cause. The primary symptom of LSS is neurogenic claudication with back and leg pain, sensory loss, and weakness in the legs. Symptoms are typically exacerbated by standing or walking and relieved with sitting or flexion at the waist.

Some sources describe the course of LSS as "progressive" or "degenerative," implying that neurologic decline is the usual course. Longer-term data from the control groups of clinical trials as well as from observational studies suggest that, over time, most patients remain stable, some improve, and some deteriorate.1,2.
The lack of a valid classification for LSS contributes to wide practice variation and uncertainty about who should be treated surgically and which surgical procedure is best for each patient.3,4 This uncertainty also complicates research on spinal stenosis, particularly the selection of appropriate eligibility criteria and comparators.5

Treatment
The largest group of patients with spinal stenosis is minimally symptomatic patients with mild back pain and no spinal instability. These patients are typically treated nonsurgically. At the other end of the spectrum are patients who have severe stenosis, concomitant back pain, and grade 2 or higher spondylolisthesis or degenerative scoliosis >25 Cobb angle who require laminectomy plus spinal fusion.

Surgical treatments for patients with spinal stenosis not responding to conservative treatments include decompression with or without spinal fusion. There are many types of decompression surgery and types of fusion operations. In general, spinal fusion is associated with more complications and a longer recovery period and, in the past, was generally reserved for patients with spinal deformity or moderate grade spondylolisthesis.

Conservative treatment for spinal stenosis may include physical therapy, pharmacotherapy, epidural steroid injections, and many other modalities.6 The terms "nonsurgical" and "nonoperative" have also been used to describe conservative treatment. Professional societies recommend that surgery for LSS should be considered only after a patient fails to respond to conservative treatment but there is no agreement about what constitutes an adequate course or duration of treatment.

The term "conservative management" may refer to "usual care" or to specific programs of nonoperative treatment, which use defined protocols for the components and intensity of conservative treatments, often in the context of an organized program of coordinated, multidisciplinary care. The distinction is important in defining what constitutes a failure of conservative treatment and what comparators should be used in trials of surgical vs nonsurgical management. The rationale for surgical treatment of symptomatic spinal stenosis rests on the Spine Patient Outcomes Research Trial (SPORT), which found that patients who underwent surgery for spinal stenosis and spondylolisthesis had better outcomes than those treated nonoperatively. The SPORT investigators did not require a specified program of nonoperative care but rather let each site decide what to offer.7 A subgroup analysis of the SPORT trial found that only 37% of nonoperatively treated patients received physical therapy in the first 6 weeks of the trial and that those who received physical therapy before 6 weeks had better functional outcomes and were less likely to cross over to surgery later.8 These findings provide some support for the view that, in clinical trials, patients who did not have surgery may have had suboptimal treatment, which can lead to a larger difference favoring surgery. The SPORT investigators asserted that their nonoperative outcomes represented typical results at a multidisciplinary spine center at the time, but recommended that future studies compare the efficacy of specific nonoperative programs to surgery.

A recent trial by Delitto et al (2015) compared surgical decompression with a specific therapy program emphasizing physical therapy and exercise.9 Patients with lumbar spinal stenosis and from 0 to 5 mm of slippage (spondylolisthesis) who were willing to be randomized to decompression surgery vs an intensive, organized program of nonsurgical therapy were eligible. Oswestry Disability Index scores were comparable to those in the SPORT trial. A high proportion of patients assigned to nonsurgical care (57%) crossed over to surgery (in SPORT the proportion was 43%), but crossover from surgery to nonsurgical care was minimal. When analyzed by treatment assignment, Oswestry Disability Index scores were similar in the surgical and nonsurgical groups after two years of follow-up. The main implication is that about one-third of patients who were deemed candidates for decompression surgery but instead entered an intensive program of conservative care achieved outcomes similar to those of a successful decompression.10,11
Diagnostic criteria for fusion surgery are challenging because patients without spondylolisthesis and those with grade 1 spondylolisthesis are equally likely to have predominant back pain or predominant leg pain. The SPORT trial did not provide guidance on which surgery is appropriate for patients who do not have spondylolisthesis, because nearly all patients with spondylolisthesis underwent fusion whereas nearly all those who did not have spondylolisthesis underwent decompression alone. In general, patients with predominant back pain have more severe symptoms, worse function, and less improvement with surgery (with or without fusion). Moreover, because back pain improved to the same degree for the fused spondylolisthesis patients as for the unfused spinal stenosis patients at two years, the SPORT investigators concluded that it was unlikely that fusion led to the better surgical outcomes in patients with spondylolisthesis than those with no spondylolisthesis.

Throughout the 2000s, decompression plus fusion became more widely used until, in 2011, it surpassed decompression alone as a surgical treatment for spinal stenosis. However, in 2016, findings from two randomized trials of decompression alone vs decompression plus fusion were published. The Swedish Spinal Stenosis Study (SSSS) found no benefit of fusion plus decompression compared with decompression alone in patients who had spinal stenosis with or without degenerative spondylolisthesis. The Spinal Laminectomy versus Instrumented Pedicle Screw (SLIP) trial found a small but clinically meaningful improvement in the Physical Component Summary score of the 36-item Short-Form Health Survey but no change in Oswestry Disability Index scores at 2, 3, and 4 years in patients who had spinal stenosis with grade 1 spondylolisthesis (3-14 mm). The patients in SLIP who had laminectomy alone had higher reoperation rates than those in SSSS, and the patients who underwent fusion had better outcomes in SLIP than in SSSS. While some interpret the studies to reflect differences in patient factors—in particular, SSSS but not SLIP included patients with no spondylolisthesis—the discrepancy may also be influenced by factors such as time of follow-up or national practice patterns. As Pearson (2016) noted, it might have been helpful to have patient-reported outcome data on the patients before and after reoperation, to see whether the threshold for reoperation differed in the 2 settings. A small trial conducted in Japan, Inose et al (2018) found no difference in patient-reported outcomes between laminectomy alone and laminectomy plus posterolateral fusion in patients with 1-level spinal stenosis and grade 1 spondylolisthesis; about 40% of the patients also had dynamic instability. Certainty in the findings of this trial is limited because of its size and methodologic flaws.

Spacer Devices
Investigators have sought less invasive ways to stabilize the spine and reduce the pressure on affected nerve roots, including interspinous and interlaminar implants (spacers). These devices stabilize or distract the adjacent lamina and/or spinous processes and restrict extension in patients with lumbar spinal stenosis and neurogenic claudication.

Interspinous Implants
Interspinous spacers are small devices implanted between the vertebral spinous processes. After implantation, the device is opened or expanded to distract the neural foramina and decompress the nerves. One type of interspinous implant is inserted between the spinous processes through a small (4-8 cm) incision and acts as a spacer between the spinous processes, maintaining flexion of that spinal interspace. The supraspinous ligament is maintained and assists in holding the implant in place. The surgery does not include any laminotomy, laminectomy, or foraminotomy at the time of insertion, thus reducing the risk of epidural scarring and cerebrospinal fluid leakage. Other interspinous spacers require removal of the interspinous ligament and are secured around the upper and lower spinous processes.

Interlaminar Spacers
Interlaminar spacers are implanted midline between the adjacent lamina and spinous processes to provide dynamic stabilization either following decompression surgery or as an alternative to decompression surgery. Interlaminar spacers have two sets of wings placed around the inferior
and superior spinous processes. They may also be referred to as interspinous U. These implants aim to restrict painful motion while enabling normal motion. The devices (spacers) distract the laminar space and/or spinous processes and restrict extension. This procedure theoretically enlarges the neural foramen and decompresses the cauda equina in patients with spinal stenosis and neurogenic claudication.

**Literature Review**

The following conclusions are based on a review of the evidence, including, but not limited to, published evidence and clinical expert opinion, via Blue Cross Blue Shield Association’s (BCBSA’s) Clinical Input Process.

Evidence reviews assess the clinical evidence to determine whether the use of technology improves the net health outcome. Broadly defined, health outcomes are the length of life, quality of life (QOL), and a ability to function-including benefits and harms. Every clinical condition has specific outcomes that are important to patients and managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of technology, two domains are examined: the relevance, and quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

The largest group of patients with spinal stenosis is minimally symptomatic patients with mild back pain and no spinal instability. These patients are typically treated nonsurgically. At the other end of the spectrum are patients who have severe stenosis, concomitant back pain, and grade 2 or higher spondylolisthesis, spinal instability, or degenerative scoliosis > 25 Cobb angle who require laminectomy plus spinal fusion.

The literature is dominated by reports from non-U.S. centers evaluating devices not approved by the U.S. Food and Drug Administration (FDA), although a number of them are in trials at U.S. centers. As of April 2018, only the X-STOP, coflex, and Superion Interspinous Spacer (ISS) devices had received the FDA approval for use in the U.S. Manufacturing of the X-STOP device stopped in 2015. This review focuses on devices currently available for use in the United States.

**Interspinous or Interlaminar Spacer as a Stand-Alone Treatment**

**Clinical Context and Therapy Purpose**

The purpose of the interspinous or interlaminar spacer in patients with spinal stenosis and no spondylolisthesis or grade 1 spondylolisthesis is to provide a treatment option that is better than lumbar spinal decompression surgery. Although not tested in trials, another potential purpose could be to provide an alternative to conservative therapy in patients who are medically unsuitable for undergoing general anesthesia for more invasive lumbar surgery or nonsurgical conservative therapy.

The question addressed in this evidence review is: Does the use of an interspinous or interlaminar spacer in patients with spinal stenosis and no spondylolisthesis or grade 1 spondylolisthesis, when used as a stand-alone treatment, improve the net health outcome?
The following PICOs were used to select literature to inform this review.

**Patients**
The relevant population of interest are patients with spinal stenosis and no spondylolisthesis or grade 1 spondylolisthesis.

**Interventions**
The treatment being considered is the placement of an interspinous or interlaminar spacer as a stand-alone treatment.

**Comparators**
The following practices are currently being used to treat with spinal stenosis with no spondylolisthesis or grade 1 spondylolisthesis: lumbar spinal decompression surgery and nonsurgical conservative therapy.

**Outcomes**
The general outcome of interest is whether the placement of an interspinous or interlaminar spacer improves function as measured by a 15-point improvement in the Oswestry Disability Index (ODI) scores. Other measures such as 36-Item Short-Form Health Survey to assess the QOL, Zurich Claudication Questionnaire (ZCQ) also to assess QOL for patients with lumbar spinal stenosis (LSS), and freedom from secondary interventions are also of interest to determine whether placement of an interspinous or interlaminar spacer improves the net health outcome. In addition, the adverse events of treatment need assessment. The window to judge treatment success is a minimum of two years postprocedure.

**Zurich Claudication Questionnaire (ZCQ)**
The ZCQ was designed specifically for use in the evaluation of physical function in patients with LSS. Subscales of the questionnaire may be used separately. For example, the 5-item Physical Function Scale is used primarily to evaluate walking capacity. These five items assess distance walked and activities of daily living involving walking. The Physical Function Scale has been used to assess walking as an outcome for surgical and nonsurgical treatment in patients with LSS.

The Zurich Claudication Questionnaire consists of three subscales:
1. Symptom severity scale (questions I-VII) [further subdivided into pain domain (questions I-IV) and a neuro-ischemic domain (questions V-VII)]: Possible range of the score is 1 to 5.
2. Physical function scale (questions VIII-XII): Possible range of scores is 1 to 4.
3. Patient's satisfaction with treatment scale (questions XIII-XVIII): The range of the scale is 1 to 4.

**Scoring Method or Interpretation**
The result is expressed as a percentage of the maximum possible score. The score increases with worsening disability.

**Oswestry Disability Index (ODI)**
The ODI is a self-administered questionnaire used by clinicians and researchers to quantify disability for low back pain. The maximum score is 50. The Minimum Detectable Change (at 90% confidence) is 10 percentage points.

Interpretation of the ODI:
1. 0%-20% Minimal disability: This group can cope with most living activities. Usually, no treatment is indicated, apart from advice on lifting, sitting posture, physical fitness, and diet. In this group, some patients have particular difficulty with sitting, and this may be important if their occupation is sedentary (e.g., a typist or truck driver).
2. 20%-40% Moderate disability: This group experiences more pain and problems with sitting, lifting, and standing. Travel and social life are more difficult and they may well be off...
work. Personal care, sexual activity, and sleeping are not grossly affected, and the back condition can usually be managed by conservative means.

3. 40%-60% Severe disability: Pain remains the main problem in this group of patients, but travel, personal care, social life, sexual activity, and sleep are also affected. These patients require detailed investigation.

4. 60%-80% Crippled: Back pain impinges on all aspects of these patients' lives—both at home and at work—and positive intervention is required.

5. 80%-100% These patients would be bed-bound.

12-Item Short Form Survey (SF-12)
This health status survey is commonly used, brief (12 questions), and provides a description of the respondent's health. The SF-12 is a measure of perceived health that describes the degree of general physical health status and mental health distress. The SF-12 is a shorter alternative to the SF-36®. The SF-12 has at least 1 question from each of the SF-36's original 8 domains. The SF-12 is scored on 2 summary scales, the Physical Component Summary scale and the Mental Component Summary scale, representing the physical and mental factors measured in the survey. Both scales are scored such that the adult population mean is 50, with a standard deviation of 10, and higher scores represent a better function.

Visual Analog Pain Score (VAS)
The VAS for pain is a continuous scale which depicts pain intensity along a line (usually 10cm [100 mm] long) that is anchored by 2 verbal descriptors, 1 for each symptom extreme. For pain intensity, the scale is most commonly anchored by "no pain" (score of 0) and "pain as bad as it could be" or "worst imaginable pain" (score of 100) on 100mm scale. Typically, respondents are asked to report current pain intensity or pain intensity in the last 24 hours.

Superion ISS Device vs X-STOP Device (Interspinous)
Patel et al (2015) reported on the results of a multicenter randomized noninferiority trial (10% margin) comparing the Superion ISS with the X-STOP.28, Trial characteristics and results are summarized in Tables 2 and 3. The primary outcome was a composite of a clinically significant improvement in at least one of three ZCQ domain scores compared with baseline; freedom from reoperation, epidural steroid injection, nerve block, rhizotomy, or spinal cord stimulator; and freedom from a major implant or procedure-related complications.

The results at 2 years of follow-up indicated that the primary noninferiority endpoint was met, with a Bayesian posterior probability of 0.993. However, 111 (28%) patients (54 Superion ISS, 57 X-STOP) withdrew from the trial during follow-up because they received a protocol-defined secondary intervention. Modified intention-to-treat analysis showed similar levels of clinical success for leg pain, back pain, and ODI scores. Rates of complications and reoperations were similar between groups. Spinous process fractures, reported as asymptomatic, occurred in 16.4% of Superion ISS patients and 8.5% of X-STOP patients. Subsequently, long-term follow-up results were reported. At 3 years, 120 patients in the Superion ISS group and 129 in the X-STOP group remained (64% [249/391]). Of them, composite clinical success (CCS) was achieved in 52.5% of patients in the Superion ISS group and 38.0% of the X-STOP group (p=0.023). The 36-month clinical outcomes were reported for 82 patients in the Superion ISS group and 76 patients in the X-STOP group (40% [158/391]). It is unclear from the reporting whether the remaining patients were lost to follow-up or were considered treatment failures and censored from the results. Also, trial interpretation is limited by questions about the efficacy of the comparator and lack of a control group treated with surgical decompression. At the 4-year and 5-year follow-ups, only data for the Superion arm were reported, which included data for 90% and 65% of originally randomized patients, respectively. Of these, success on at least 2 of 3 ZCQ domains was observed in 84% of patients at years 4 and 5. Nunley et al (2018) reported a decrease in opioid use (n=107) and improvement in the QOL (n=68) at 5 years, however, results were reported only for patients who had not undergone reoperation or revision, limiting interpretation of these results.29,30.
The purpose of the limitations tables (see Tables 4 and 5) is to display notable limitations identified in each study. This information is synthesized as a summary of the body of evidence following each table and provides the conclusions on the sufficiency of the evidence supporting the position statement.

**Table 2. Summary of Key RCT Characteristics**

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Countries</th>
<th>Sites</th>
<th>Dates</th>
<th>Participants</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patel et al (2015); NC00692276</td>
<td>U.S.</td>
<td>29</td>
<td>2008-2011</td>
<td>Patients with intermittent neurogenic claudication despite 6 mo of nonsurgical management (N=440)</td>
<td>Superion ISS (n=218) X-STOP spacers (n=222)</td>
</tr>
</tbody>
</table>

RCT: randomized controlled trial.

**Table 3. Results of Noninferiority Trials Comparing Superion With X-STOP**

<table>
<thead>
<tr>
<th>Study</th>
<th>Group</th>
<th>n</th>
<th>Success Rates</th>
<th>VAS Leg Pain</th>
<th>VAS Back Pain</th>
<th>ODI Scores</th>
<th>Spine Process Fractures</th>
<th>Reoperation Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years</td>
<td>Patel et al (2015)</td>
<td>136</td>
<td>75%</td>
<td>76%</td>
<td>67%</td>
<td>63%</td>
<td>16.4%</td>
<td>44 (23.2%)</td>
</tr>
<tr>
<td></td>
<td>X-STOP</td>
<td>144</td>
<td>75%</td>
<td>77%</td>
<td>68%</td>
<td>67%</td>
<td>8.5%</td>
<td>38 (18.9%)</td>
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<tr>
<td>3 years</td>
<td>Patel et al (2015)</td>
<td>120</td>
<td>52.5%</td>
<td>69/82</td>
<td>63/82</td>
<td>57/82</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>X-STOP</td>
<td>129</td>
<td>38.0%</td>
<td>53/76</td>
<td>53/76</td>
<td>55/77</td>
<td></td>
<td></td>
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<tr>
<td>4 years</td>
<td>Nunley et al (2017)</td>
<td>122</td>
<td>84.3%</td>
<td>67/86</td>
<td>57/86</td>
<td>55/89</td>
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<tr>
<td>5 years</td>
<td>Nunley et al (2017)</td>
<td>88</td>
<td>84%</td>
<td>68/85</td>
<td>55/85</td>
<td>57/88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are n, %, or n (%).

ODI: Oswestry Disability Index; VAS: visual analog scale.

a Percentage achieving at least a 20 mm improvement on a 100-mm VAS score.
b Percentage achieving at least a 15% improvement in ODI scores.
c Composite outcome based on 4 components: improvement in 2 of 3 domains of the Zurich Claudication Questionnaire, no reoperations at the index level, no major implant/procedure-related complications, and no clinically significant confounding treatments.
d Clinical success on at least 2 of 3 Zurich Claudication Questionnaire domains.

**Table 4. Relevance Limitations**

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcomes</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patel et al (2015)</td>
<td>28,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

a Population key: 1. Intended use population unclear; 2. Clinical context is unclear; 3. Study population is unclear; 4. Study population not representative of intended use.
b Intervention key: 1. Not clearly defined; 2. Version used unclear; 3. Delivery not similar intensity as comparator; 4. Not the intervention of interest.
c Comparator key: 1. Not clearly defined; 2. Not standard or optimal; 3. Delivery not similar intensity as intervention; 4. Not delivered effectively.
d Outcomes key: 1. Key health outcomes not addressed; 2. Physiologic measures, not validated surrogates; 3. No CONSORT reporting of harms; 4. Not establish and validated measurements; 5. Clinical significant difference not prespecified; 6. Clinical significant difference not supported.
e Follow-Up key: 1. Not sufficient duration for benefit; 2. Not sufficient duration for harms.

**Table 5. Study Design and Conduct Limitations**

<table>
<thead>
<tr>
<th>Study</th>
<th>Allocation</th>
<th>Blinding</th>
<th>Selective Reporting</th>
<th>Data Completeness</th>
<th>Power</th>
<th>Statistical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patel et al (2015)</td>
<td>3. Allocation</td>
<td>1. Not clear</td>
<td>1. High loss to follow up and/or missing data: 11% of why a 10% noninferiority</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interspinous and Interlaminar Stabilization/Distraction Devices (Spacers)

The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

- **Blinding key**: 1. Not blinded to treatment assignment; 2. Not blinded outcome assessment; 3. Outcome assessed by treating physician.
- **Selective Reporting key**: 1. Not registered; 2. Evidence of selective reporting; 3. Evidence of selective publication.
- **Data Completeness key**: 1. High loss to follow-up or missing data; 2. Inadequate handling of missing data; 3. High number of crossovers; 4. Inadequate handling of crossovers; 5. Inappropriate exclusions; 6. Not intent to treat analysis (per protocol for noninferiority trials).
- **Power key**: 1. Power calculations not reported; 2. Power not calculated for primary outcome; 3. Power not based on clinically important difference.
- **Statistical key**: 1. Analysis is not appropriate for outcome type: (a) continuous; (b) binary; (c) time to event; 2. Analysis is not appropriate for multiple observations per patient; 3. Confidence intervals and/or p values not reported; 4. Comparative treatment effects not calculated.

### Table 6. Summary of Key RCT Characteristics

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Countries</th>
<th>Sites</th>
<th>Dates</th>
<th>Participants</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moojen et al (2013) (^{34,35}); FELIX</td>
<td>Netherlands</td>
<td>5</td>
<td>2008-2011</td>
<td>Patients with intermittent neurogenic claudication due to lumbar stenosis with an indication for surgery (N=159)</td>
<td>Coflex (n=80)</td>
</tr>
</tbody>
</table>

**RCT:** randomized controlled trial.

### Table 7. Summary of Key RCT Outcomes

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Proportions of Patients Achieving ZCQ success, (^a) (95% CI), %</th>
<th>Reoperations, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8 Weeks</strong></td>
<td><strong>52 Weeks</strong></td>
<td></td>
</tr>
<tr>
<td>Moojen et al (2013; 2014) (^{34,35}); FELIX (1-yr follow-up)</td>
<td>63 (51 to 73) 66 (54 to 74)</td>
<td>21 (29)</td>
</tr>
<tr>
<td>Coflex</td>
<td>72 (60 to 81)</td>
<td>6 (8)</td>
</tr>
<tr>
<td>Decompression alone</td>
<td>0.73 (0.44)</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

\(^a\) Noninferiority margin selected.
Interspinous and Interlaminar Stabilization/Distraction Devices (Spacers)

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Proportions of Patients Achieving ZCQ Success, (^a) (95% CI), %</th>
<th>Reoperations, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moojen et al (2015)(^3); FELIX (2-yr follow-up)</td>
<td>145</td>
<td>Not reported</td>
</tr>
<tr>
<td>Coflex</td>
<td>69</td>
<td>23 (33)</td>
</tr>
<tr>
<td>Decompression alone</td>
<td>60</td>
<td>6 (8)</td>
</tr>
<tr>
<td>Odds ratio (p)</td>
<td>0.65 (0.20)</td>
<td>(&lt;0.001)</td>
</tr>
</tbody>
</table>

CI: confidence interval; RCT: randomized controlled trial; ZCQ: Zurich Claudication Questionnaire.

\(^a\) Reductions in ZCQ scores were categorized as successful if at least 2 domain subscales were judged as “success.” The ZCQ has 3 domains: symptoms severity, physical function, and patient's satisfaction. Success in the domains was defined as a decrease of at least 0.5 points on the symptom severity scale and on the physical function scale or a score of less than 2.5 on the patient's satisfaction subscale.

Section Summary: Interspinous or Interlaminar Spacers as Stand-Alone Treatment

The evidence for the Superion ISS for LSS includes a pivotal trial. This trial compared the Superion ISS with the X-STOP but did not include comparison groups for conservative treatment or standard surgery. The trial reported significantly better outcomes on some measures. For example, the percentage of patients experiencing improvements in certain QOL outcome domains was reported at over 80%. However, this percentage was based on 40% of the original dataset. Interpretation of this trial is limited by uncertainty about a number of patients used to calculate success rates, the lack of efficacy of the comparator, and the lack of an appropriate control group treated by surgical decompression.

The coflex interlaminar implant was compared with decompression in the multicenter, double-blind FELIX trial. Functional outcomes and pain levels between the 2 groups at 1-year follow-up did not differ statistically but reoperation rates due to lack of recovery were statistically higher with the coflex implant (29%) compared with bony decompression (8%). It is not clear whether patients with reoperations were included in pain and function assessments; if they were, this would have decreased assessment scores at one year. For patients with 2-level surgery, the reoperation rate was 38% for coflex and 6% for bony decompression. At 2 years, reoperations due to the absence of recovery had been performed in 33% of the coflex group compared with 8% of the bony decompression group. This is an off-label use of the device. Use consistent with the FDA label is reviewed in the next section.

Interlaminar Stabilization Devices Used With Spinal Decompression Surgery in Patients With Severe Spinal Stenosis and Grade 1 Spondylolisthesis

Clinical Context and Therapy Purpose

The purpose of placement of an interlaminar spacer in patients with severe spinal stenosis and grade 1 spondylolisthesis is to provide a treatment option that is less invasive than lumbar spinal decompression surgery with fusion and more effective for back pain than lumbar spinal decompression surgery alone. Lumbar spinal stenosis has a broad clinical spectrum. Features that may affect the choice of the surgical procedure include the severity of leg pain, back pain, and instability; the presence of facet hypertrophy, diminished disc height, or deformity; the risk of general anesthesia, and the patient's preferences. The clinical feature that best distinguishes the target population for coflex is the severity of back pain, specifically, back pain that is worse than the leg pain. The hypothesis underlying this use of coflex is that decompression alone, while effective for claudication and other symptoms of spinal stenosis, may be less effective for severe back pain than decompression plus a stabilizing procedure.

The question addressed in this evidence review is: Does the use of an interlaminar spacer in patients with spinal stenosis and no spondylolisthesis or grade 1 spondylolisthesis when used as an adjunct to spinal decompression improve the net health outcome?

The following PICO\(^\text{s}\) were used to select literature to inform this review.
Patients
Individuals with severe spinal stenosis and grade 1 spondylolisthesis who have not responded to conservative treatment.

Interventions
The treatment being considered is the placement of an interlaminar spacer as an adjunct to spinal decompression.

Comparators
The comparators are lumbar spinal decompression with spinal fusion and lumbar spinal decompression surgery without fusion.

Outcomes
The main outcomes of interest are (1) improvements in symptoms of spinal stenosis (e.g., claudication, leg pain), (2) reductions in back pain, and (3) reductions in limitations on activities related to symptoms. Symptoms can be measured by scores of validated instruments such as the ODI and the ZCQ as well as VAS for back and leg pain. Other measures such as the 36-Item Short-Form Health Survey to assess the QOL are relevant. Other key outcome measures are reoperations, including fusion procedures, and adverse events. The window to judge treatment success is a minimum of two years postprocedure.

coflex Device Plus Decompression vs Decompression Plus Posterolateral Fusion
The FDA approved coflex on the basis of an open-label, randomized, multicenter, noninferiority trial (-10% noninferiority margin) that compared coflex plus decompression to decompression plus posterolateral fusion in patients who had stenosis, significant back pain, and either no spondylolisthesis or grade 1 spondylolisthesis. The control group was treated with pedicle screw and rod fixation with autograft but without an interbody (intervertebral) cage or bone morphogenetic protein. A total of 398 patients were randomized, of whom 322 were included in the per-protocol analysis. Of 215 coflex patients in the per-protocol analysis, 11 were lost to follow-up at the 2-year endpoint. In the fusion group, 3 of 107 were lost to follow-up. Results of long-term follow-up to five years were reported subsequently.

Trial characteristics and results are summarized in Tables 8 and 9. CCS (a minimum 15-point improvement in ODI score, no reoperations, no device-related complications, no epidural steroid injections in the lumbar spine, and no persistent new or worsening sensory or motor deficit) at 24 months showed that coflex was noninferior to screw and rod fixation (-10% noninferiority margin). Secondary effectiveness criteria, which included ZCQ score, VAS scores for leg and back pain, SF-12 scores, time to recovery, patient satisfaction, and several radiographic endpoints, tended to favor the coflex group. The percentages of device-related adverse events (5.6%) did not differ statistically between the two groups. Wound problems were more frequent in the coflex group (14% vs. 6.5%) but all of these resolved by 3 months. There was a 14% incidence of spinous process fractures in the coflex arm, which were reported to be mostly asymptomatic. The reported follow-up rates through 5 years were at least 85%.

At 2 years, overall success was similar for patients treated with the coflex device at 1 or 2 levels (68.9% and 69.4%, respectively). At 60 months, the CCS was achieved in 48.3% of 1 level and 60.9% of 2 level patients.

A secondary (unplanned) analysis of patients with grade 1 spondylolisthesis (99 coflex patients and 51 fusion patients) showed a decrease in operative time (104 vs 157 minutes; p <0.001) and blood loss (106 vs 336 ml, p <0.001). There were no statistically significant differences between the coflex and fusion groups in ODI, VAS, and ZCQ scores after two years. In that analysis, 59 (62.8%) of 94 coflex patients and 30 (62.5%) of 48 fusion patients met the criteria for operative success. Fusion was obtained in 71% of the control group, leaving nearly a third of patients with pseudoarthrosis. The authors reported no significant differences in ODI or VAS between the patients with pseudoarthrosis or solid fusion, but ZCQ scores were not reported. There were 18
(18%) spinous process fractures in the coflex group, of which 7 had healed by the 2-year follow-up. Reoperation rates were 6% in the fusion group (p=0.18) and 14% in the coflex group, including 8 (8%) coflex cases that required conversion to fusion.

### Table 8. Summary of Key RCT Characteristics

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Countries</th>
<th>Sites</th>
<th>Dates</th>
<th>Participants</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis et al (2013)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>U.S.</td>
<td>21</td>
<td>2006-2008</td>
<td>Patients with spinal stenosis with up to grade 1 spondylolisthesis, 1 or 2 levels with VAS &gt;50 and ODI &gt;20 (N=344)</td>
<td>Decompression plus Coflex (n=262)</td>
</tr>
</tbody>
</table>

ODI: Oswestry Disability Index; RCT: randomized controlled trial; VAS: visual analog score

<sup>a</sup> Noninferiority study.

### Table 9. Summary of Key RCT Outcomes

<table>
<thead>
<tr>
<th>Study</th>
<th>CCS&lt;sup&gt;a&lt;/sup&gt;</th>
<th>15-Point Improvement in ODI Score</th>
<th>No Secondary Surgical Intervention or Lumbar Injection</th>
<th>No Secondary Surgical Intervention</th>
<th>No Secondary Lumbar Injection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2-year follow-up</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Davis et al (2013)&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>308</td>
<td>248</td>
<td>322</td>
<td>215</td>
<td>215</td>
</tr>
<tr>
<td>Coflex</td>
<td>135 (66)</td>
<td>139 (86)</td>
<td>173 (81)</td>
<td>192 (89)</td>
<td>190 (88)</td>
</tr>
<tr>
<td>Fusion</td>
<td>104 (58)</td>
<td>66 (77)</td>
<td>89 (83)</td>
<td>99 (93)</td>
<td>94 (88)</td>
</tr>
<tr>
<td>%D (95% CI) or p</td>
<td>8.5&lt;sup&gt;b&lt;/sup&gt; (-2.9 to 20.0)</td>
<td>9 (NR)</td>
<td>2 (NR)</td>
<td>-4 (NR)</td>
<td>0</td>
</tr>
<tr>
<td><strong>3-year follow-up</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bae et al (2016)&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>290</td>
<td>214</td>
<td>Unclear</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Coflex</td>
<td>(62)</td>
<td>129 (90)</td>
<td>(76)</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Fusion</td>
<td>(49)</td>
<td>53 (76)</td>
<td>(79)</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>%D (95% CI) or p</td>
<td>13.3 (1.1 to 25.5)</td>
<td>0.008</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>4-year follow-up</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bae et al (2015)&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>274</td>
<td>181</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Coflex</td>
<td>106 (58)</td>
<td>106 (86)</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Fusion</td>
<td>42 (47)</td>
<td>42 (72)</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>%D (95% CI) or p</td>
<td>10.9 (-1.6 to 23.5)</td>
<td>0.038</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>5-year follow-up</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musacchio et al (2016)&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>282</td>
<td>179</td>
<td>322</td>
<td>322</td>
<td>322</td>
</tr>
<tr>
<td>Coflex</td>
<td>96 (50)</td>
<td>100 (81)</td>
<td>148 (69)</td>
<td>179 (83)</td>
<td>173 (81)</td>
</tr>
<tr>
<td>Fusion</td>
<td>40 (44)</td>
<td>41 (75)</td>
<td>71 (66)</td>
<td>89 (83)</td>
<td>82 (77)</td>
</tr>
<tr>
<td>%D (95% CI) or p</td>
<td>6.3 (NR); &gt;0.90</td>
<td>&gt;0.40 &gt;0.70</td>
<td>&gt;0.90</td>
<td>&gt;0.40</td>
<td></td>
</tr>
</tbody>
</table>

Values are n or n (%)<sup>f</sup>

CCS: composite clinical success; CI: confidence interval; FU: follow-up; NR: not reported; ODI: Oswestry Disability Index (reported as mean score or percent with at least 15-point improvement).

<sup>a</sup> CCS was composed of a minimum 15-point improvement in ODI score, no reoperations, no device-related complications, no epidural steroid injections in the lumbar spine, and no persistent new or worsening sensory or motor deficit.

<sup>b</sup> The lower bound of Bayesian posterior credible interval for the device group difference in CCS was equal to -2.9%, which is within the prespecified noninferiority margin of -10%

Tables 10 and 11 display notable limitations identified in each study.

Another limitation in the study, not listed in the limitations tables, is that other published evidence about the use of coflex as an alternative to fusion is sparse. The results of a single randomized trial do not always correspond with the rates of treatment response, complications, and reoperations in actual practice. Although thousands of coflex operations have been performed in the U.S. and elsewhere, there are few data on the performance of coflex plus...
decompression surgery other than in randomized trials. A retrospective cohort study (NCT03041896) undertaken by the manufacturer has not been reported, and a large registry of studies is not yet complete (NCT02457468).

### Table 10. Relevance Limitations

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Population</th>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcomes</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis et al (2013)³⁸; NCT00534235</td>
<td>4. Study population combines no and grade 1 spondylolisthesis</td>
<td>2. Noninferiority to a comparator whose benefit is uncertain does not permit meaningful interpretation of the net benefit.</td>
<td>1. Outcomes did not include success of the fusion procedure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Davis et al (2013)³⁹; NCT00534235</td>
<td>2. The benefit of the comparator is uncertain. Fusion was not obtained in 29% of cases. Intervertebral cages and BMP were not allowed in the FDA IDE study.</td>
<td>1. Outcomes did not include success of the fusion procedure.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BMP: bone morphogenetic protein; IDE: investigational device exemption; FDA: Food and Drug Administration

The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

- **Population key:**
  1. Intended use population unclear;
  2. Clinical context is unclear;
  3. Study population is unclear;
  4. Study population not representative of intended use.

- **Intervention key:**
  1. Not clearly defined;
  2. Version used unclear;
  3. Delivery not similar intensity as comparator;
  4. Not the intervention of interest.

- **Comparator key:**
  1. Not clearly defined;
  2. Not standard or optimal;
  3. Delivery not similar intensity as intervention;
  4. Not delivered effectively.

- **Outcomes key:**
  1. Key health outcomes not addressed;
  2. Physiologic measures, not validated surrogates;
  3. No CONSORT reporting of harms;
  4. Not establish and validated measurements;
  5. Clinical significant difference not prespecified;
  6. Clinical significant difference not supported.

- **Follow-Up key:**
  1. Not sufficient duration for benefit;
  2. Not sufficient duration for harms.

### Table 11. Study Design and Conduct Limitations

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Allocation</th>
<th>Blinding</th>
<th>Selective Reporting</th>
<th>Data Completeness</th>
<th>Power</th>
<th>Statistical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis et al (2013)³⁹; NCT00534235</td>
<td>3. Evidence of selective reporting. ZQ scores were not reported for the comparison of pseudoarthrosis and solid fusion.</td>
<td>1. Secondary (unplanned) superiority testing in patients with grade 1 spondylolisthesis patients from the pivotal non-inferiority trial.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Non-inferiority margin for the subgroup analysis was not defined or discussed and confidence intervals were not reported.
ZCQ: Zurich Claudication Questionnaire.
The study limitations stated in this table are those notable in the current review; this is not a comprehensive
limitations assessment.

a Allocation key: 1. Participants not randomly allocated; 2. Allocation not concealed; 3. Allocation
concealment unclear; 4. Inadequate control for selection bias.
b Blinding key: 1. Not blinded to treatment assignment; 2. Not blinded outcome assessment; 3. Outcome
assessed by treating physician. 4. No independent adjudication or preset criteria for subsequent
intervention.
c Selective Reporting key: 1. Not registered; 2. Evidence of selective reporting; 3. Evidence of selective
publication.
d Data Completeness key: 1. High loss to follow-up or missing data; 2. Inadequate handling of missing data;
3. High number of crossovers; 4. Inadequate handling of crossovers; 5. Inappropriate exclusions; 6. Not
intention-to-treat analysis (per protocol for noninferiority trials).
e Power key: 1. Power calculations not reported; 2. Power not calculated for primary outcome; 3. Power not
based on clinically important difference.
f Statistical key: 1. Analysis is not appropriate for outcome type: (a) continuous; (b) binary; (c) time to event;
2. Analysis is not appropriate for multiple observations per patient; 3. Confidence intervals and/or p values
not reported; 4. Comparative treatment effects not calculated.

Subsection Summary: coflex Device Plus Decompression vs Decompression Plus Posterolateral
Fusion
The FDA’s approval of coflex was based on an open-label, randomized, noninferiority trial that
compared the noninferiority of coflex plus decompression to decompression plus posterolateral
fusion in patients who had spinal stenosis, significant back pain, and up to grade 1
spondylolisthesis. Use of the noninferiority framework by the FDA assumed that decompression
plus fusion was the standard of care for patients with spinal stenosis with up to grade 1
spondylolisthesis and, because fusion is a more invasive procedure that requires longer
operative time and has a potential for higher surgical and postsurgical complications,
demonstrating noninferiority with a less invasive procedure such as coflex would be adequate to
demonstrate a net benefit in health outcomes. However, subsequent to the approval of
coflex, two RCTs the Swedish Spinal Stenosis Study (SSSS), and the Spinal Laminectomy versus
Instrumented Pedicle Screw (SLIP) assessing the superiority of adding fusion to decompression
over decompression alone reported a lack of or marginal benefit. The SSSS trial, which was
adequately powered to detect a 12-point difference in ODI score, showed no difference in ODI
scores between the 2 treatment arms. Hence, the results generated from a noninferiority trial
using a comparator whose net benefit on health outcomes is uncertain confound meaningful
interpretation of its results. Secondary (posthoc) comparison of the subgroup of patients with
grade 1 spondylolisthesis, which may be a more relevant analysis, found similar outcomes
between the coflex and fusion groups. However, almost a third of the fusion group had
unsuccessful fusion with pseudoarthrosis which raises additional questions about the efficacy of
the comparator. ODI and VAS did not significantly differ between the pseudoarthrosis and solid
fusion groups, but the ZCQ results were not reported. In addition, posthoc analysis is considered
hypothesis-generating. Given the multiple concerns, a prospective trial that compares coflex to
fusion in patients with severe spinal stenosis and grade 1 spondylolisthesis is needed.

coflex Device Plus Decompression vs Decompression Alone
Schmidt et al (2018) reported on results of an RCT in patients with moderate-to-severe LSS and
back pain with or without spondylolisthesis randomized to open microsurgical decompression
with interlaminar stabilization using the coflex device (n=110) or open microsurgical
decompression alone (n=115). 45,46 Trial characteristics and results at 24 months are summarized in
Tables 12 and 13. The proportion of patients who met the criteria for CCS at 24 months was
statistically and significantly higher in the coflex arm (58.4%) than in the decompression alone
arm (41.7%; p=0.017), with a treatment difference of 16.7% (95% confidence interval, 3.1% to
30.2%). This result was driven primarily by the lower proportion of patients who received an
epidural steroid injection in the coflex arm (4.5%) vs the decompression alone arm (14.8%
p=0.010) at 24 months.
The proportion of patients with ODI success among those censored for subsequent secondary interventions was not statistically significant between the treatment (75.6%) and the control arms (70.4%, p = 0.47). The difference in the proportion of patients overall who had ODI success in the overall sample was also not statistically significant (55% vs 44%, p = 0.091).

None of the other outcomes (data not shown) showed statistically significant differences between the treatment and control arms; outcomes included success measured on the ZCQ (success was defined as an improvement in 2 or 3 ZCQ criteria), success measured on a VAS for pain (success defined as a >20-mm change from baseline), reduction in VAS leg pain, success on a walking distance test (either ≥8-minute walk improvement or the ability to walk to the maximum 15-minute limit), the proportion of patients receiving secondary surgical interventions, or 1- and 2-year survival (Kaplan-Meier) estimates without secondary surgical interventions or survival curves for time to first secondary intervention.

Table 12. Summary of Key RCT Characteristics

<table>
<thead>
<tr>
<th>Study; Trial</th>
<th>Countries</th>
<th>Sites</th>
<th>Dates</th>
<th>Participants</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schmidt et al (2018)</td>
<td>Germany</td>
<td>7</td>
<td>2008-2014</td>
<td>Patients with moderate-to-severe LSS with or without spondylolisthesis and significant back pain (N=255)</td>
<td>Decompression with interlaminar stabilization (n=129)</td>
</tr>
<tr>
<td>NCT01316211</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open microsurgical decompression alone (n=131)</td>
</tr>
</tbody>
</table>

LSS: lumbar spinal stenosis; RCT: randomized controlled trial.

Table 13. Summary of Key RCT Outcomes

<table>
<thead>
<tr>
<th>Study</th>
<th>CCS</th>
<th>15-Point Improvement in ODI Score (all patients)</th>
<th>15-Point Improvement in ODI Score (those not receiving a secondary intervention)</th>
<th>No Secondary Surgical Intervention or Lumbar Injection</th>
<th>No Secondary Surgical Intervention</th>
<th>No Secondary Lumbar Injection</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>204</td>
<td>255</td>
<td>132</td>
<td>225</td>
<td>225</td>
<td>225</td>
</tr>
<tr>
<td>D plus ILS</td>
<td>59 (58)</td>
<td>69 (55)</td>
<td>62 (76)</td>
<td>91 (83)</td>
<td>96 (87)</td>
<td>105 (96)</td>
</tr>
<tr>
<td>D alone</td>
<td>43 (42)</td>
<td>57 (44)</td>
<td>50 (70)</td>
<td>84 (73)</td>
<td>98 (85)</td>
<td>98 (85)</td>
</tr>
<tr>
<td>%D (95% CI)</td>
<td>16.7</td>
<td>10.6</td>
<td>5.2</td>
<td>9.7</td>
<td>2.1</td>
<td>10.2</td>
</tr>
<tr>
<td>p</td>
<td>0.017</td>
<td>0.091</td>
<td>0.470</td>
<td>0.081</td>
<td>0.655</td>
<td>0.010</td>
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</tbody>
</table>

Values are n, n (%) or %.
CCS: composite clinical success; CI: confidence interval; D: decompression; ILS: interlaminar stabilization; ODI: Oswestry Disability Index; RCT: Randomized controlled trial.

a CCS defined as meeting all 4 criteria: (1) ODI success with improvement >15 points; (2) survivorship with no secondary surgical intervention or lumbar injection; (3) neurologic maintenance or improvement without worsening; and (4) no device- or procedure-related severe adverse events.

The purpose of the limitations tables (see Tables 14 and 15) is to display notable limitations identified in each study. Major limitations are discussed below.

- Based on the reporting by Schmidt et al (2018), 254 patients were randomized but data for only 204 patients were analyzed for the primary outcome measure.45 Thus, data of 20% of patients were excluded. While the proportion of patients excluded was comparable in both arms, the investigators did not explain the missing data of these 50 patients. Lack of a consistent approach in reporting and handling of missing data (patients who remained in the trial but for whom data for repeated longitudinal measures were missing), including describing methods to minimize missing data, reporting reasons for missing data, and using appropriate multiple imputation statistical techniques and sensitivity analysis to handle missing data, makes interpretation of trial results challenging.

- The observed treatment effect on the primary composite outcome was primarily driven by a reduction in the use of rescue epidural steroid injection. One concern is a bias that
could have been introduced by the open-label design where the treating surgeon also made the assessment that additional intervention with lumbar steroid was needed. The trial design did not include features commonly used to address this problem, such as preset criteria for subsequent intervention, or independent blinded adjudication to verify that subsequent intervention was merited.

- The inclusion of epidural and facet joint injections in the endpoint may be inappropriate for this trial. Epidural injections are less invasive than reoperations, revisions, removal, and supplemental fixations. Nonsurgical therapy, including epidural or facet injections, would be an expected adjunct to decompression alone in patients with predominant back pain. In this context, epidural injections may be offered to provide temporary pain relief that allows a patient to progress with a rehabilitative stretching and exercise program. Censoring patients who undergo particular components of nonsurgical back care may be inappropriate in this context. A better approach would be to measure and report ODI for all patients, or ODI success in all patients except for those who have revisions or reoperations, at 24 months.

- Because of concerns about potential bias, inconsistent reporting of analysis as intention-to-treat, and a lack of critical discussion of the number, timing, pattern, and reason for and possible implications of missing values, the magnitude of difference might have been overestimated.

### Table 14. Relevance Limitations

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcomes</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schmidt et al (2018)</td>
<td>1. Intended use population unclear; 2. Clinical context is unclear; 3. Study population is unclear; 4. Study population not representative of intended use.</td>
<td>1. In the control arm, nonsurgical treatment for back pain after decompression should be described</td>
<td>3. No CONSORT reporting of harms</td>
<td>1. Present study reports only on the first 2 y of the 5-y follow-up required by the FDA</td>
<td></td>
</tr>
</tbody>
</table>

The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

FDA: Food and Drug Administration.

- Population key: 1. Intended use population unclear; 2. Clinical context is unclear; 3. Study population is unclear; 4. Study population not representative of intended use.
- Intervention key: 1. Not clearly defined; 2. Version used unclear; 3. Delivery not similar intensity as comparator; 4. Not the intervention of interest.
- Comparator key: 1. Not clearly defined; 2. Not standard or optimal; 3. Delivery not similar intensity as intervention; 4. Not delivered effectively.

### Table 15. Study Design and Conduct Limitations

<table>
<thead>
<tr>
<th>Study</th>
<th>Allocation</th>
<th>Blinding</th>
<th>Selective Reporting</th>
<th>Data Completeness</th>
<th>Power</th>
<th>Statistical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schmidt et al (2018)</td>
<td>1. Not blinded to treatment assignment; 4. No independent adjudication or preset criteria for subsequent intervention</td>
<td>1. High loss to follow-up or missing data; 2. Inadequate handling of missing data. LOCF may not be the most appropriate approach</td>
<td>6. Not intention-to-treat analysis</td>
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<td></td>
<td></td>
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</tbody>
</table>

The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

LOCF: last observation carried forward.

Röder et al (2015) reported on a small cross-registry study that compared lumbar decompression plus coflex (SWISS spine Registry) with lumbar decompression alone (Spine Tango Registry) in 50 pairs matched by a multifactorial propensity score. The SWISS spine is a governmentally mandated registry from Switzerland for coverage with evidence development. Spine Tango is a voluntary registry from the Spine Society of Europe. Both registries use the numeric rating scale (NRS) for back and leg pain, as well as the Core Outcome Measures Index as the patient-based outcome instrument. The Core Outcome Measures Index consists of seven questions to evaluate pain, function, well-being, QOL, and disability. At 7- to 9-month follow-up, the coflex group had greater reductions in NRS back pain score (3.8 vs 2.5, p=0.014), NRS leg pain score (4.3 vs 2.5, p<0.001), NRS maximum pain score (4.1 vs 2.3, p=0.002), and greater improvement in Core Outcome Measures Index score (3.7 vs 2.5; p=0.029). Back pain improved by the minimum clinically relevant change in about 60% of patients in the decompression alone group vs 78% in the coflex plus decompression group.

Because of substantial baseline differences between the compared groups, small sample size, and short follow-up time, there is a high-risk that the Röder et al (2015) study’s estimate of the effect of decompression alone vs decompression plus coflex is biased. Decompression alone had better outcomes than those reported by Röder et al (2015) in a larger, well-conducted, 12-month European registry study of patients with spinal stenosis, significant back, and no spondylolisthesis.

Richter et al (2010) reported on a prospective case-control study of the coflex device in 60 patients who underwent decompression surgery. Richter et al (2014) also published a 2-year follow-up. The surgeon determined whether the midline structures were preserved or resected and whether the coflex device was implanted (one or two levels). The indications for the two groups were identical and the use of the device was considered incidental to the surgery. At 1- and 2-year follow-ups, placement of a coflex device did not significantly improve the clinical outcome compared with decompression surgery alone.

Some radiologic findings with the coflex device require additional study to determine their clinical significance. Tian et al (2013) reported a high rate (81.2%) of heterotopic ossification at follow-up (range, 24-57 months) in patients who had received a coflex device. In 16 (50%) of 32 patients, heterotopic ossification was detected in the interspinous space but had not bridged the space, while in 2 (6.3%) patients there was interspinous fusion. In the nine patients followed for more than three years, class II (interspinous space but not bridging) and class III (bridging) heterotopic ossification was detected in all nine. Lee et al (2016) reported erosion around the spinous process and reductions in disc height and range of motion in patients treated with a coflex device plus spinal decompression and had at least 24 months of follow-up. Erosion around the coflex device, which was observed in 47% of patients, has the potential to result in spinous process fracture or device malposition. Continued follow-up is needed.
**Subsection Summary: coflex Device Plus Decompression vs Decompression Alone**

One RCT, conducted in a patient population who had moderate-to-severe LSS with or without spondylolisthesis, showed that a greater proportion of patients who received coflex plus decompression achieved the primary endpoint of CCS compared with decompression alone. This composite endpoint was primarily driven by a greater proportion of patients who received a secondary rescue epidural steroid injection in the control arm while there was no difference in the proportion of patients who achieved a meaningful reduction of 15 points in ODI score in the treatment and the control arms. However, the decision to use rescue epidural steroid injection introduced possible bias given that the trial was open-label. No attempts were made to mitigate this potential bias using protocol-mandated standard objective clinical criteria to guide decisions about the use of secondary interventions and subsequent adjudication of these events by an independent blinded committee. Given these critical shortcomings, trial results might have been biased. Greater certainty about the net health outcome of adding coflex to decompression surgery might be demonstrated when results of 5-year follow-up of this trial and an ongoing RCT (NCT02555280) on decompression with and without the coflex implant in the U.S. are published. Consideration of existing studies as indirect evidence regarding the outcomes of using spacers in this subgroup is limited by substantial uncertainty regarding the balance of potential benefits and harms. Limitations of the published evidence preclude determining the effects of the technology on net health outcome. Evidence reported through clinical input offered varying degrees of support but was not predominantly supportive of a clinically meaningful improvement in net health outcome for this population. While some of the expert opinions supported a potential benefit in carefully selected individuals, other experts were not confident of a clinically meaningful benefit or use in generally accepted medical practice, citing long-term complications leading to the removal of the device. Further details from clinical input included in the Clinical Input section later in the review and the Appendix.

**Interlaminar Stabilization Devices Used With Spinal Decompression Surgery in Patients With No Spondylolisthesis or Instability**

**Clinical Context and Therapy Purpose**

The purpose of placement of an interlaminar spacer in patients with spinal stenosis and no spondylolisthesis or spinal instability is to provide a treatment option that is less invasive than lumbar spinal decompression surgery with fusion and more effective for back pain than lumbar spinal decompression surgery alone. LLS has a broad clinical spectrum. Features that may affect the choice of the surgical procedure include the severity of leg pain, back pain, and instability; the presence of facet hypertrophy, diminished disc height, or deformity; the risk of general anesthesia, and the patient's preferences. The clinical feature that best distinguishes the target population for coflex is the severity of back pain, specifically, back pain that is worse than the leg pain. The hypothesis underlying this use of coflex is that decompression alone, while effective for claudication and other symptoms of spinal stenosis, may be less effective for severe back pain than decompression plus a stabilizing procedure.

The question addressed in this evidence review is: Does the use of an interlaminar spacer in patients with spinal stenosis and no spondylolisthesis or no grade 1 spondylolisthesis, when used as an adjunct to spinal decompression, improve the net health outcome?

The following PICO(s) were used to select literature to inform this review.

**Patients**

Individuals with spinal stenosis and no spondylolisthesis or instability who have not responded to conservative treatment.

**Interventions**

The treatment being considered is the placement of an interlaminar spacer as an adjunct to spinal decompression.
Comparators
The comparators are lumbar spinal decompression alone.

Outcomes
The main outcomes of interest are (1) improvements in symptoms of spinal stenosis (e.g., claudication, leg pain), (2) reductions in back pain, and (3) reductions in limitations on activities related to symptoms. Symptoms can be measured by scores of validated instruments such as the ODI and the ZCQ as well as VAS for back and leg pain. Other measures such as the 36-Item Short-Form Health Survey to assess the QOL are relevant. Other key outcome measures are reoperations, including fusion procedures, and adverse events. The window to judge treatment success is a minimum of two years postprocedure.

coflex Device Plus Decompression vs Decompression Plus Posterolateral Fusion
Abjornson et al (2018) reported outcomes from the subgroup of patients without spondylolisthesis who received an interlaminar device with decompression in the pivotal investigational device exemption trial, but comparison with decompression alone in this population has not been reported.44 The major weakness in this trial was its use of lumbar spinal fusion as a comparator for patients with no spondylolisthesis. The underlying premise that patients with back pain and spinal stenosis do not respond well to decompression (alone or followed by nonsurgical treatments for back pain) has been challenged. For example, the ODI success rate for decompression alone in the European Study of Coflex And Decompression Alone trial43 was comparable to the ODI success rate for decompression plus fusion in the pivotal trial.

Section Summary: Interlaminar Stabilization Devices Used With Spinal Decompression Surgery in Patients With No Spondylolisthesis or Instability
The pivotal RCT, conducted in a patient population with spondylolisthesis no greater than grade 1 and significant back pain, showed that stabilization of decompression with the coflex implant was noninferior to decompression with spinal fusion for the CCS measure. However, there is uncertainty about the net benefit of routinely adding spinal fusion to decompression in patients with no spondylolisthesis. Fusion after open decompression laminectomy is a more invasive procedure that requires longer operative time and has a potential for higher procedural and postsurgical complications. When the trial was conceived, decompression plus fusion was viewed as the standard of care for patients with spinal stenosis with up to grade 1 spondylolisthesis and back pain; thus demonstrating noninferiority with a less invasive procedure such as coflex would be adequate to result in a net benefit in health outcomes. However, the role of fusion in the population of patients represented in the pivotal trial is uncertain, especially since the publication of the SSSS and the SUP, 2 RCTs comparing decompression alone with decompression plus spinal fusion that was published in 2016. As a consequence, results generated from a noninferiority trial using a comparator whose net benefit on health outcome is uncertain confounds meaningful interpretation of trial results. Therefore, demonstrating the noninferiority of coflex plus spinal decompression vs spinal decompression plus fusion, a comparator whose benefit on health outcomes is uncertain, makes it difficult to apply the results of the study. Outcomes from the subgroup of patients without spondylolisthesis who received an interlaminar device with decompression in the pivotal investigational device exemption trial have been published, but comparison with decompression alone in this population has not been reported. Limitations of the published evidence preclude determining the effects of the technology on net health outcome. Evidence reported through clinical input offered varying degrees of support but was not predominantly supportive of a clinically meaningful in net health outcome, with respondents noting an increase in complications and need for additional surgery compared to laminectomy alone. Further details from clinical input are included in the Clinical Input section and the Appendix.

Summary of Evidence
The following conclusions are based on a review of the evidence, including, but not limited to, published evidence and clinical expert opinion, via BCBSA’s Clinical Input Process.
For individuals who have spinal stenosis and no spondylolisthesis or grade 1 spondylolisthesis who receive an interspinous or interlaminar spacer as a stand-alone procedure, the evidence includes two RCTs of two spacers (Superion Indirect Decompression System, coflex interlaminar implant). The relevant outcomes are symptoms, functional outcomes, QOL, and treatment-related morbidity. Overall, the use of interspinous or interlaminar distraction devices (spacers) as an alternative to spinal decompression has shown high failure and complication rates. A pivotal trial compared the Superion ISS with the X-STOP (which is no longer marketed), without conservative care or standard surgery comparators. The trial reported significantly better outcomes with the Superion ISS on some measures. For example, the trial reported more than 80% of patients experienced improvements in certain QOL outcome domains. Interpretation of this trial is limited by questions about the number of patients used to calculate success rates, the lack of efficacy of the comparator, and the lack of an appropriate control group treated by surgical decompression. The coflex interlaminar implant (formerly called the interspinous U) was compared with decompression in the multicenter, double-blind FELIX trial. Functional outcomes and pain levels were similar in the 2 groups at 1-year follow-up, but reoperation rates due to the absence of recovery were substantially higher with the coflex implant (29%) than with bony decompression (8%). For patients with 2-level surgery, the reoperation rate was 38% for coflex and 6% for bony decompression. At 2 years, reoperations due to the absence of recovery had been performed in 33% of the coflex group and 8% of the bony decompression group. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have severe spinal stenosis and grade 1 spondylolisthesis who have failed conservative therapy who receive an interlaminar spacer with spinal decompression surgery, the evidence includes two RCTs with a mixed population of patients. The relevant outcomes are symptoms, functional outcomes, QOL, and treatment-related morbidity. Use of the coflex interlaminar implant as a stabilizer after surgical decompression has been studied in two situations— as an adjunct to decompression compared with decompression alone (superiority) and as an alternative to spinal fusion after decompression (noninferiority). For decompression with coflex vs decompression with lumbar spinal fusion, the pivotal RCT, conducted in a patient population with spondylolisthesis no greater than grade 1 and significant back pain, showed that stabilization of decompression with the coflex implant was noninferior to decompression with spinal fusion for the CCS measure. A secondary (unplanned) analysis of patients with grade 1 spondylolisthesis (99 coflex patients and 51 fusion patients) showed a decrease in operative time (104 vs 157 minutes; p < 0.001) and blood loss (106 vs 336 ml, p < 0.001). There were no statistically significant differences between the coflex and fusion groups in ODI, VAS, and ZCQ scores after two years. In that analysis, 62.8% of coflex patients and 62.5% of fusion patients met the criteria for operative success. The efficacy of the comparator in this trial is uncertain because successful fusion was obtained in only 71% of the control group, leaving nearly a third of patients with pseudoarthrosis. The report indicated no significant differences in ODI or VAS between the patients with pseudoarthrosis or solid fusion, but ZCQ scores were not reported. There were 18 (18%) spinous process fractures in the coflex group, of which 7 had healed by the 2-year follow-up. Reoperation rates were 6% in the fusion group and 14% in the coflex group (p = 0.18), including 8 (8%) coflex cases that required conversion to fusion. This secondary analysis is considered hypothesis-generating, and a prospective trial in patients with grade 1 spondylolisthesis is needed. In an RCT conducted in a patient population with moderate-to-severe LSS with significant back pain and up to grade 1 spondylolisthesis, there was no difference in the primary outcome measure, the ODI, between the patients treated with coflex plus decompression vs. decompression alone. CCS, defined as a minimum 15-point improvement in ODI score, no reoperations, no device-related complications, no epidural steroid injections in the lumbar spine, and no persistent new or worsening sensory or motor deficit, was used to assess superiority. A greater proportion of patients who received coflex plus decompression instead of decompression alone achieved the composite endpoint. However, the superiority of coflex plus decompression is uncertain because the difference in the CCS was primarily driven by a greater proportion of patients in the control arm who received a secondary rescue epidural steroid injection. Because the trial was open-label, surgeons’ decision to use epidural steroid injection could have been affected by their knowledge of the patient’s
treatment. Consequently, including this component in the CCS measure might have overestimated the potential benefit of treatment. Analysis was not reported separately for the group of patients who had grade 1 spondylolisthesis, leaving the question open about whether the implant would improve outcomes in this population. Limitations of the published evidence preclude determining the effects of the technology on net health outcome, and evidence reported through clinical input is not universally supportive of a clinically meaningful improvement in net health outcome. While some respondents considered the shorter recovery time and lower complication rate to be an advantage compared to fusion, others noted an increase in complications and the need for additional surgery with the device. Consideration of existing studies as indirect evidence regarding the outcomes of using spacers in this subgroup is limited by substantial uncertainty regarding the balance of potential benefits and harms. The evidence is insufficient to determine the effect of the technology on health outcomes.

For individuals who have spinal stenosis and no spondylolisthesis who receive an interlaminar spacer with spinal decompression surgery, the evidence includes an RCT. The relevant outcomes are symptoms, functional outcomes, QOL, and treatment-related morbidity. The pivotal RCT, conducted in a patient population with spondylolisthesis no greater than grade 1 and significant back pain, showed that stabilization of decompression with the coflex implant was noninferior to decompression with spinal fusion for the CCS measure. However, in addition to concerns about the efficacy of fusion in this study, there is uncertainty about the net benefit of routinely adding spinal fusion to decompression in patients with no spondylolisthesis. Fusion after open decompression laminectomy is a more invasive procedure that requires longer operative time and has a potential for higher procedural and postsurgical complications. When the trial was conceived, decompression plus fusion was viewed as the standard of care for patients with spinal stenosis with up to grade 1 spondylolisthesis and back pain; thus demonstrating noninferiority with a less invasive procedure such as coflex would be adequate to result in a net benefit in health outcomes. However, the role of fusion in the population of patients represented in the pivotal trial is uncertain, especially since the publication of the SSSS and the SLIP, 2 RCTs comparing decompression alone with decompression plus spinal fusion that were published in 2016. As a consequence, results generated from a noninferiority trial using a comparator whose net benefit on health outcome is uncertain confounds meaningful interpretation of trial results. Therefore, demonstrating the noninferiority of coflex plus spinal decompression vs spinal decompression plus fusion, a comparator whose benefit on health outcomes is uncertain, makes it difficult to apply the results of the study. Outcomes from the subgroup of patients without spondylolisthesis who received an interlaminar device with decompression in the pivotal IDE trial have been published, but comparison with decompression alone in this population has not been reported. Limitations of the published evidence preclude determining the effects of the technology on net health outcome. Evidence reported through clinical input is not generally supportive of a clinically meaningful improvement in net health outcome, with clinical experts noting an increase in complications and need for additional surgery compared to laminectomy alone. The evidence is insufficient to determine the effects of the technology on health outcomes.

**Objective**

In 2018, clinical input was sought to help determine whether the use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment would provide a clinically meaningful improvement in net health outcome and whether the use is consistent with generally accepted medical practice.

**Respondents**

Clinical input was provided by the following specialty societies and physician members identified by a specialty society or clinical health system:

- American Association of Neurological Surgeons (AANS) and Congress of Neurological Surgeons (CNS)
- International Society for Advancement of Spine Surgery (ISASS)
Clinical input provided by the specialty society at an aggregate level is attributed to the specialty society. Clinical input provided by a physician member designated by a specialty society or health system is attributed to the individual physician and is not a statement from the specialty society or health system. Specialty society and physician respondents participating in the Evidence Street clinical input process provide a review, input, and feedback on topics being evaluated by Evidence Street. However, participation in the clinical input process by a specialty society and/or physician member designated by a specialty society or health system does not imply an endorsement or explicit agreement with the Evidence Opinion published by BCBSA nor any Blue Plan.

Clinical Input Responses

<table>
<thead>
<tr>
<th>Indication</th>
<th>Respondent</th>
<th>Specialty</th>
<th>Identified by</th>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
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<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade I spondylolisthesis who failed conservative treatment.</td>
<td>AAMS/CNS</td>
<td>Neurosurgery</td>
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<tr>
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<td></td>
<td>Dr. Hitchon</td>
<td>Neurosurgery</td>
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<td></td>
<td>Dr. Annaswamy</td>
<td>Phys Med &amp; Rehab</td>
<td>AAM&amp;R</td>
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</table>

NR=not reported; grey shaded=not reported

Additional comments:

- "Interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade I spondylolisthesis who failed conservative treatment provides a clinically meaningful improvement in net health outcomes. The rationale is that the addition of interlaminar spacer may provide the additional stability for patients with micro-instability, or decrease the chance of iatrogenic micro-instability when extensive facet joint resection is needed for decompression. The addition of interlaminar spacer might also help with pain from facet arthropathy at the treated level from unloading the facet joint. Patients with back pain predominant lumbar spinal stenosis with and without grade I spondylolisthesis represent a challenging clinical scenario. A valid comparator in this predominant back pain population would be spinal decompression surgery with fusion. As mentioned in the evidence summary, the shorter recovery time and lower complication rate associated with decompression and interlaminar spacer when compared with decompression and fusion would be expected to and does demonstrate a clinically meaningful improvement in net health outcomes." (AAMS/CNS)

- "The 'Population' is now described as a Stenosis patient with ‘predominant back pain.’ The ILS (coflex) population has never been defined as having ‘predominant back pain,’ and the population described by the PICO does not comply with the PMA approval by the FDA or with the ISASS Recommendations/Coverage Criteria for Decompression with Interlaminar Stabilization - Coverage, Indications, Limitations, and/or Medical Necessity on Decompression with Interlaminar Stabilization (D-HLS). We believe the inclusion of
'predominant back pain' for the population undermines a functional and fair clinical review as this is not an indication for ILS. Lumbar Spinal Stenosis (LSS) patients do not typically have ‘predominant back pain'. We believe it is clinically inappropriate to include this in the patient population description and recommend removal." (ISASS)

- "Interspinous non-fusion devices (IPD) such as X-Stop, Coflex, Diam, have been shown to be equally effective in the short term, as non-fusion laminectomy in the treatment of lumbar stenosis and neurogenic claudication without instability." (Dr. Hitchon, Neurosurgery, University of Iowa Hospitals & Clinics)

- "Interspinous devices may have short term benefits, with shorter hospital stays. These benefits, however, are outweighed with the need of additional surgery, exceeding that in patients undergoing decompression without such devices. These conclusions are consistent across several peer-reviewed publications." (Dr. Hitchon, Neurosurgery, identified by University of Iowa Hospitals & Clinics)

- "We do not use these devices in our neurosurgery practice. Based on findings from the literature, and experiences gained from caring for patients who had these devices implanted by outside surgeons, we are not convinced they are in the patient’s best interest." (Anonymous, Neurosurgery, identified by an academic medical center)

- "Clinically, these devices have utility in patients that do not want to consider decompression and fusion, or those that cannot move forward with general anesthesia." (Anonymous, Physical Medicine and Rehabilitation, identified by the American Academy of Physical Medicine and Rehabilitation)

Supplemental Information
Clinical Input From Physician Specialty Societies and Academic Medical Centers
While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

2018 Input
In response to requests from Blue Cross Blue Shield Association, clinical input on the use of interlaminar spacer with spine decompression in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment was received from 6 respondents, including 2 specialty society-level responses and 4 physician-level responses, including 2 identified through a specialty society and 2 through an academic medical center, in 2018. Evidence from clinical input is integrated within the Rationale section summaries and the Summary of Evidence.

2011 Input
In response to requests Blue Cross Blue Shield Association, input was received from 2 physician specialty societies and 2 academic medical centers in 2011. Two of those providing input agreed this technology is investigational due to the limited high-quality data on long-term outcomes (including durability). Two reviewers did not consider this technology investigational, stating that it has a role in the treatment of selected patients with neurogenic intermittent claudication.

2009 Input
In response to requests Blue Cross Blue Shield Association, input was received from 1 physician specialty society and 3 academic medical centers in 2009. Differing input was received; several reviewers indicated data were sufficient to demonstrate improved outcomes.

Practice Guidelines and Position Statements
International Society for the Advancement of Spine Surgery
The International Society for the Advancement of Spine Surgery (2016) published recommendations and coverage criteria for decompression with interlaminar stabilization. The Society concluded that an interlaminar spacer in combination with decompression can provide
stabilization in patients who do not present with greater than grade 1 instability. Criteria included:

1. Radiographic confirmation of at least moderate lumbar stenosis
2. Radiographic confirmation of the absence of gross angular or translatory instability of the spine at index or adjacent levels
3. Patients who experience relief in flexion from their symptoms of leg/buttocks/groin pain, with or without back pain, and who have undergone at least 12 weeks of non-operative treatment.

The document did not address interspinous and interlaminar distraction devices without decompression.

**North American Spine Society**

The NASS(2018) published specific coverage policy recommendations on the lumbar interspinous device without fusion and with decompression.54 The NASS recommended that:

"Stabilization with an interspinous device without fusion in conjunction with laminectomy may be indicated as an alternative to lumbar fusion for degenerative lumbar stenosis with or without low-grade spondylolisthesis (less than or equal to 3 mm of anterolisthesis on a lateral radiograph) with qualifying criteria when appropriate:

1. Significant mechanical back pain is present (in addition to those symptoms associated with neural compression) that is felt unlikely to improve with decompression alone. Documentation should indicate that this type of back pain is present at rest and/or with movement while standing and does not have characteristics consistent with neurogenic claudication.
2. A lumbar fusion is indicated post-decompression for a diagnosis of lumbar stenosis with a Grade 1 degenerative spondylolisthesis as recommended in the NASS Coverage Recommendations for Lumbar Fusion.
3. A lumbar laminectomy is indicated as recommended in the NASS Coverage Recommendations for Lumbar Laminectomy.
4. Previous lumbar fusion has not been performed at an adjacent segment.
5. Previous decompression has been performed at the intended operative segment.

Interspinous devices are NOT indicated in cases that do not fall within the above parameters. In particular, they are not indicated in the following scenarios and conditions:

1. Degenerative spondylolisthesis of Grade 2 or higher.
2. Degenerative scoliosis or other signs of coronal instability.
3. Dynamic instability as detected on flexion-extension views demonstrating at least 3 mm of change in translation.
4. Iatrogenic instability or destabilization of the motion segment.
5. A fusion is otherwise not indicated for a Grade 1 degenerative spondylolisthesis and stenosis as per the NASS Coverage Recommendations for Lumbar Fusion.
6. A laminectomy for spinal stenosis is otherwise not indicated as per the NASS Coverage Recommendations for Lumbar Laminectomy."

**American Pain Society**

The guidelines from the American Pain Society (2009) indicated that interspinous spacer devices, based on fair evidence, have a B recommendation (clinicians should consider offering the intervention).55,56 The net benefit was considered moderate through two years, with insufficient evidence to estimate the net benefit for long-term outcomes.

**National Institute for Health and Care Excellence**

The National Institute for Health and Care Excellence (2010) published guidance that indicated "Current evidence on interspinous distraction procedures for lumbar spinal stenosis causing neurogenic claudication shows that these procedures are efficacious for carefully selected"
patients in the short and medium-term, although failure may occur and further surgery may be
needed. The evidence reviewed consisted mainly of reports on X-STOP.

**U.S. Preventive Services Task Force Recommendations**

Not applicable.

**Medicare National Coverage**

There is no national coverage determination. In the absence of a national coverage
determination, coverage decisions are left to the discretion of local Medicare carriers.

**Ongoing and Unpublished Clinical Trials**

Some currently ongoing and unpublished trials that might influence this review are listed in Table
16.

**Table 16. Summary of Key Trials**

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ongoing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02555280a</td>
<td>A 2 and 5 Year Comparative Evaluation of Clinical Outcomes in the Treatment of Degenerative Spinal Stenosis With Concomitant Low Back Pain by Decompression With and Without Additional Stabilization Using the Coflex® Interlaminar Technology for FDA Real Conditions of Use Study (Post-Approval 'Real Conditions of Use' Study)</td>
<td>345</td>
<td>Jun 2022</td>
</tr>
<tr>
<td>NCT02457468a</td>
<td>The Coflex®COMMUNITY Study: An Observational Study of Coflex® Interlaminar Technology</td>
<td>500</td>
<td>Jun 2023</td>
</tr>
<tr>
<td><strong>Unpublished</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT03041896a</td>
<td>Retrospective Evaluation of the Clinical and Radiographic Performance of Coflex® Interlaminar Technology Versus Decompression With or Without Fusion</td>
<td>5000</td>
<td>Aug 2018 (completed)</td>
</tr>
</tbody>
</table>

NCT: national clinical trial.
a Denotes industry-sponsored or cosponsored trial.
### Appendix

#### Respondent Profile

**Specialty Society**

<table>
<thead>
<tr>
<th>#</th>
<th>Name of Organization</th>
<th>Clinical Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>American Association of Neurological Surgeons (AANS) and Congress of Neurological Surgeons (CNS)</td>
<td>Neurosurgery</td>
</tr>
<tr>
<td>2</td>
<td>International Society for Advancement of Spine Surgery (ISASS)</td>
<td>Spine surgery</td>
</tr>
</tbody>
</table>

**Physician**

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Degree</th>
<th>Institutional Affiliation</th>
<th>Clinical Specialty</th>
<th>Board Certification and Fellowship Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Patrick W. Hitchon</td>
<td>MD</td>
<td>Professor of Neurosurgery and Bioengineering, Department of Neurosurgery University of Iowa Hospitals &amp; Clinics</td>
<td>Neurosurgery</td>
<td>American Board of Neurological Surgery; Fellowship - Cardiovascular Physiology, University of Iowa Hospitals &amp; Clinics, Iowa City, Iowa</td>
</tr>
<tr>
<td>4</td>
<td>Anonymous</td>
<td>MD</td>
<td></td>
<td>Neurosurgery</td>
<td>American Board of Neurological Surgery</td>
</tr>
<tr>
<td>5</td>
<td>Thiru Annaswamy</td>
<td>MD</td>
<td>Veterans Administration North Texas Health Care System</td>
<td>Physical Medicine and Rehabilitation</td>
<td>Physical Medicine and Rehabilitation</td>
</tr>
<tr>
<td>6</td>
<td>Anonymous</td>
<td>MD</td>
<td>Physical Medicine and Rehabilitation</td>
<td>FAAPMR, Pain Medicine, Sports Medicine</td>
<td></td>
</tr>
</tbody>
</table>

#### Respondent Conflict of Interest Disclosure

<table>
<thead>
<tr>
<th>#</th>
<th>1) Research support related to the topic where clinical input is being sought</th>
<th>2) Positions, paid or unpaid, related to the topic where clinical input is being sought</th>
<th>3) Reportable, more than $1,000, healthcare-related assets or sources of income for myself, my spouse, or my dependent children related to the topic where clinical input is being sought</th>
<th>4) Reportable, more than $350, gifts or travel reimbursements for myself, my spouse, or my dependent children related to the topic where clinical input is being sought</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES/NO Explanation</td>
<td>YES/NO Explanation</td>
<td>YES/NO Explanation</td>
<td>YES/NO Explanation</td>
</tr>
<tr>
<td>1</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Individual physician respondents answered at an individual level. Specialty Society respondents provided aggregate information that may be relevant to the group of clinicians who provided input to the Society-level response. NR = not reported.
Clinical Input Responses

Objective

Interspinous and interlaminar implants (spacers) stabilize or distract the adjacent lamina and/or spinous processes and restrict extension to reduce pain in patients with lumbar spinal stenosis and neurogenic claudication. Interspinous spacers are small devices implanted between the vertebral spinous processes. After implantation, the device is opened or expanded to distract (open) the neural foramen and decompress the nerves. Interlaminar spacers are implanted midline between the adjacent lamina and spinous processes to provide dynamic stabilization either following decompression surgery or as an alternative to decompression surgery.

The following PICO applies to this indication.

<table>
<thead>
<tr>
<th>Populations</th>
<th>Interventions</th>
<th>Comparators</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals:</td>
<td>Interventions of interest are:</td>
<td>Comparators of interest are:</td>
<td>Relevant outcomes include:</td>
</tr>
<tr>
<td>• With spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment</td>
<td>• Interlaminar spacer with spinal decompression surgery</td>
<td>• Lumbar spinal decompression with spinal fusion</td>
<td>• Symptoms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lumbar spinal decompression alone</td>
<td>• Functional outcomes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Quality of life</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Treatment-related morbidity</td>
</tr>
</tbody>
</table>

Clinical input is sought to help determine whether the use of an interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain and no or grade 1 spondylolisthesis who failed conservative treatment would provide a clinically meaningful improvement in net health outcome and whether the use is consistent with generally accepted medical practice.

Responses

1. We are seeking your opinion on whether using the interventions for the below indications provide a clinically meaningful improvement in net health outcome. Please respond based on the evidence and your clinical experience. Please address these points in your response:
   - Relevant clinical scenarios (e.g., a chain of evidence) where the technology is expected to provide a clinically meaningful improvement in net health outcome;
   - Any relevant patient inclusion/exclusion criteria or clinical context important to consider in identifying individuals for this indication;
   - Supporting evidence from the authoritative scientific literature (please include PMID).

Rationale

1. Interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment provides a clinically meaningful improvement in net health outcomes. The rationale is that the addition of interlaminar spacer may provide the additional stability for patients with micro-instability, or decrease the chance of iatrogenic micro-instability when extensive facet joint resection is needed for decompression. The addition of interlaminar spacer might also help with pain from facet arthropathy at the treated level from unloading the facet joint. Patients with back pain predominant lumbar spinal stenosis with and without grade 1 spondylolisthesis represent a challenging clinical scenario. A valid comparator in this predominant back pain population would be spinal decompression surgery with fusion. As mentioned in the evidence summary, the shorter recovery time and lower complication rate associated with decompression and interlaminar spacer when compared with decompression and fusion would be expected to and does demonstrate a clinically meaningful improvement in net health outcomes. The assertion that SSSS and SUP results would remove the decompression and fusion comparator is not valid. The study groups in those two studies were not identical and SUP did
show clinical benefit of decompression and fusion. We believe that this question is beyond the scope of this query, and should be addressed in a wider evidence-based review. There is now increasing evidence of the durable noninferiority of spinal decompression with interlaminar spacer versus spinal decompression and fusion in appropriately selected patients.


2 The "Population" is now described as a Stenosis patient with "predominant back pain." The ILS (coflex) population has never been defined as having "predominant back pain," and the population described by the PICO does not comply with the PMA approval by the FDA or with the ISASS Recommendations/Coverage Criteria for Decompression with Interlaminar Stabilization - Coverage, Indications, Limitations, and/or Medical Necessity on Decompression with Interlaminar Stabilization (D+ILS). We believe the inclusion of "predominant back pain" for the population undermines a functional and fair clinical review as this is not an indication for ILS. Lumbar Spinal Stenosis (LSS) patients do not typically have "predominant back pain". We believe it is clinically inappropriate to include this in the patient population description and recommend removal. The ILS PRCTs did not study this patient, LSS with "predominant back pain," but rather, the PRCTs conducted were on LSS patients with neurogenic claudication, leg pain and with back pain. Never is it contemplated that the primary symptom is "predominant back pain" nor is this the patient ("Population") defined in any of the studies referenced in the Evidence Review. It appears these changes were made without clinical input from spine surgeons or without consideration of the Davis publication or the ILS FDA approved Indications for Use. Limiting the population for ILS devices with decompression to those patients with "predominant back pain" is inconsistent with the clinical use of ILS and the FDA approved label. The US FDA label for ILS indications states: "Patients with at least moderate impairment in function, who experience relief in flexion from their symptoms of leg/buttocks/groin pain, with or without back pain" This label paints a clear picture of a patient with symptoms of moderate to severe LSS.

***ILS (coflex) is actually contraindicated in patients with "axial pain only, with no leg, buttock, or groin pain." *** The IDE trial included patients with an average ODI of 61 and an MRI with severe or moderate radiographic stenosis. Patients enrolled in the trial had similar VAS back and VAS leg scores at baseline. Surgery for "predominant back pain" is a complex topic distinct from the evidence for LSS. Surgical treatment of LSS is uncontroversial, and we do not believe it is appropriate for ES to conflate/confuse this with "predominant back pain" surgery.

We also are having difficulty understanding why ES is having such difficulty determining the net health benefits of the ILS procedure. ISASS believes the current evidence is overwhelming as reflected in the ISASS statement and position, as well as the North American Spine Society (NASS) from May 2018.

3 Interspinous non-fusion devices (IPD) such as X-Stop, Coflex, Diam, have been shown to be equally effective in the short term, as non-fusion laminectomy in the treatment of lumbar stenosis and neurogenic claudication without instability. A meta-analysis (Deyo et al, Interspinous Spacers Compared to Decompression or Fusion for Lumbar Stenosis: Complications and Repeat Operations in the Medicare Population, Spine2013 May 1; 38(10)) using Medicare inpatient claims between 2006 and 2009 data, compared comorbidity for patients with spinal stenosis having surgery (n=99,084) with (1) an interspinous process spacer alone; (2) laminectomy and a spacer; (3) decompression alone; or (4) lumbar fusion (1-2 level). Patients receiving a spacer alone had fewer major medical complications than those undergoing decompression or fusion surgery (1.2% versus 1.8% and 3.3% respectively), but had higher rates of further inpatient lumbar surgery (16.7% versus 8.5% for decompression and 9.8% for fusion at 2 years). Hospital payments for spacer surgery were greater than for decompression alone but less than for fusion procedures. Their conclusion was that "Compared to decompression or fusion, IPD pose a trade-off in outcomes: fewer complications for the index operation, but higher rates of revision". A second meta-analysis from Australia (Phan et al, Interspinous process spacers versus traditional decompression for lumbar spinal stenosis: systematic review and meta-analysis, J Spine Surg 2016;2(1):31-40) reviewed 11 published studies comparing interspinous devices with decompression alone. The conclusion of the analysis showed "no superiority for mid- to long-term patient-reported outcomes for IPD compared with traditional bony decompression, with lesser surgical complications (4% vs. 8.7%, P=0.03) but at the risk of significantly higher reoperation rates (23.7% vs. 8.5%, P<0.00001).
# Rationale

A third review of the literature in 2017 showed that though the initial hospital stay may be shorter with the devices than laminectomy alone, a higher percentage of instrumented patients will require additional surgery with time (6-85%, Ravindra, Ghogawala, Neurosurg Clin N Am 28 (2017) 321-330). This will add to the cost, superseding laminectomy, and undermining any benefits of these implants.

4 We do not use these devices in our neurosurgery practice. Based on findings from the literature, and experiences gained from caring for patients who had these devices implanted by outside surgeons, we are not convinced they are in the patient's best interest.

5 No response

6 No response

NR = not reported

2. Based on the evidence and your clinical experience for each of the clinical indications described in Question 1:
   a. Respond YES or NO for each clinical indication whether the intervention would be expected to provide a clinically meaningful improvement in net health outcome; AND
   b. Rate your level of confidence in your YES or NO response using the 1 to 5 scale outlined below.

<table>
<thead>
<tr>
<th>#</th>
<th>Indications</th>
<th>YES / NO</th>
<th>Low Confidence</th>
<th>Intermediate Confidence</th>
<th>High Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>Yes</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>NR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>Yes</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

NR = not reported
3. Based on the evidence and your clinical experience for each of the clinical indications described in Question 1:
   a. Respond YES or NO for each clinical indication whether this intervention is consistent with generally accepted medical practice; AND
   b. Rate your level of confidence in your YES or NO response using the 1 to 5 scale outlined below.

<table>
<thead>
<tr>
<th>#</th>
<th>Indications</th>
<th>YES / NO</th>
<th>Low Confidence</th>
<th>Intermediate Confidence</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>Yes</td>
<td>1</td>
<td>2</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>Yes</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Use of interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment.</td>
<td>No</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

NR = not reported

4. Additional narrative rationale or comments regarding clinical pathway and/or any relevant scientific citations (including the PMID) supporting your clinical input on this topic.

<table>
<thead>
<tr>
<th>#</th>
<th>Additional Comments</th>
</tr>
</thead>
</table>
| 1 | Interlaminar spacer with spinal decompression surgery in individuals with spinal stenosis, predominant back pain, and no or grade 1 spondylolisthesis who failed conservative treatment provides a clinically meaningful improvement in net health outcomes also when compared directly to those patients who underwent spinal decompression alone. The pivotal RCT, conducted in a patient population who had moderate-to-severe LSS with or without spondylolisthesis, showed that a greater proportion of patients who received coflex plus decompression achieved the primary endpoint of composite clinical success compared with decompression alone. The difference in success was in part attributed to a larger number of patients receiving "rescue" epidural and facet injections. Although there is potential bias from the unblinded decision of committing certain patients (more in the decompression arm) to injections without a clear algorithm there is also very clearly the potential for a confounding or masking effect of these interventions with respect to back pain. The increased use of these measures in the postoperative period could be interpreted as a failure to address the underlying pain generator and their increased use may represent a failure of the study treatment to address low back pain. More long-term results are expected.  
| 2 | ISASS has previously reviewed the ILS evidence and has determined that there is a net health benefit with the use of an ILS (coflex being the only one currently marketed) and have issued a coverage recommendation. |

NR = not reported
We have reviewed the BCBS Interspinous and Interlaminar Stabilization/Distraction Devices (Spacers) Evidence Summary. In general, this is a comprehensive review, but we have the following comments for consideration.

Interspinous Spacers (ISP) versus Interlaminar Stabilization (ILS) devices: We feel that it is confusing to include these two classes of devices in the same context. The US FDA labels and IDE trials for current and previous interspinous process (ISP) devices are for implantation without direct surgical decompression (i.e. stand-alone). The US FDA label and IDE trial for the Interlaminar Stabilization (ILS) device are for implantation with direct surgical decompression. ISP and ILS devices are biomechanically different, have different mechanisms of action and are intended for distinctly different patient populations with significant differences in disease severity. ISP devices are placed between the spinous processes without direct decompression, with their only point of contact being the spinous process. ILS devices, although also placed between the spinous processes are combined with a direct decompression and their main point of contact and fixation is on the vertebral lamina. It is unfortunate that these two types of devices are being confounded, particularly considering the poor historic clinical outcomes associated with the ISP devices. The ILS devices have a much stronger long-term (5 years published) clinical evidence.

Please note that our Coverage Recommendation, issued November 2016, is applicable to ILS devices and is silent on the ISP devices. By combining these two types of devices Evidence Street (ES) is blurring the distinction between them. This is further confounding in that ES is citing an off-label use ILS study which has no relevance to ILS evidence and coverage recommendations. Moojen et al. reported on a study of coflex, used off-label, functionally as an ISP without a direct decompression and not as an ILS is intended to be used with direct decompression. As expected when using a device inappropriately the results of the Moojen trial are unfavorable, and unjustly is a poor reflection on the proper clinical use of the ILS device. The use of the ILS in the Moojen study is not consistent with the FDA Approved Indications for Use for coflex, which is the only ILS available in the U.S. In order to avoid this confusion and misrepresentation we recommend removing Moojen from this evidence review.

PICO Table
With regards to the PICO Table ES provided for clinical input, we feel the new addition of the Population which now includes "predominant back pain" confuses and confounds the interpretation of the evidence. ES has newly and wrongly changed the population of patients by adding with "predominant back pain" to the Population category of the PICO table. In April 2018, ISASS submitted our response to your request for Clinical Input. We agreed with the Population in the PICO Table that was submitted at that time. We are perplexed by the change of the Population definition in the current PICO table. The ILS intended population was changed to include an inappropriate qualifier as having "predominant back pain." The addition of "predominant back pain" is an improper clinical indication for ILS. ILS is not intended for this patient population nor does any of the evidence cited utilize this indication. It appears these changes were arbitrary and made without clinical input from spine surgeons or without consideration of the Davis publication or the ILS FDA approved Indications for Use. It is clear that the PRCTs conducted using the ILS were on LSS patients with neurogenic claudication, leg pain and with concomitant back pain but never is it contemplated that the primary symptom is "predominant back pain".

It is inappropriate and not productive to evaluate the published evidence in the context of an arbitrarily defined PICO, in which the studies conducted did not include the patient population that is now suddenly being defined in the PICO.

The surgical treatment of patients with "predominant back pain" is a complex and controversial topic, the discussion of which cannot be subordinated to a policy on stenosis. Surgical treatment of stenosis is evidence-based, and ES cannot confuse or confound this with the controversies surrounding "predominant back pain" surgery. Lumbar spinal stenosis causes claudication and radicular pain, and its surgical treatment targets those symptoms. Secondarily, patients with stenosis may have concomitant back pain which may respond to surgery in some circumstances.

The addition of "predominant back pain" is inconsistent with the clinical use of ILS and the FDA approved label. The US FDA label for ILS states it is indicated for:
"Patients with at least moderate impairment in function, who experience relief in flexion from their symptoms of leg/buttocks/groin pain, with or without back pain"

ILS is actually contraindicated in patients with "axial pain only, with no leg, buttock, or groin pain." This label paints a clear picture of a patient with symptoms of moderate to severe LSS.

The IDE trial included patients with an average ODI of 61 and an MRI with severe or moderate radiographic stenosis. Patients enrolled in the trial had similar VAS back and VAS leg scores at baseline.

Regarding the Overview by Evidence Review Indications section, again it is not surprising that ES has concluded that the evidence is "Uncertain" considering that Indication 2 has inserted the "predominant back pain" language, which makes uninterpretable all the evidence supporting the use of the ILS device.

With regards to the discussion of the SPORT study on page 3 of the ES Evidence Summary we offer the following:
Evidence Street is correct in citing that one rationale for "surgical treatment of symptomatic spinal stenosis rests on the Spine Patient Outcomes Trial (SPORT), which found that patients who underwent surgery for spinal stenosis and spondylolisthesis had better outcomes than those treated non-operatively." However, Evidence Street has selectively interpreted the many follow-up and subset analyses of this landmark trial. This appears to be due to a mistaken attempt to make isolated "predominant back pain" as the primary diagnostic criterion for fusion surgery. Evidence Street stated that "nearly all patients with spondylolisthesis underwent fusion whereas nearly all those who did not have spondylolisthesis underwent decompression alone". This was the structure of separate studies of patients with stenosis but with and without spondylolisthesis in the trial.

However, Evidence Street fails to note that the results for patients undergoing fusion are much more nuanced than Evidence Street's mistaken attempt to isolate predominant back pain as a diagnostic criterion. Evidence Street cites Pearson et al.1 to support the statement that patients without spondylolisthesis and with grade 1 spondylolisthesis are equally likely to have predominant back pain and predominant leg pain." However, Evidence Street fails to note that the authors' conclusion that "patients with predominant leg pain had baseline scores indicative of less severe symptoms", which is a serious confounder in the interpretation of these results. Also, only about a quarter of patients were classified as predominant back pain, and a mixed pain profile was most common. These findings limit the use of this classification as an isolated criterion.

Evidence Street cites Pearson et al.2 to support the assertion that "back pain improved to the same degree for the fused spondylolisthesis patients than for the unfused spinal stenosis patients at 2 years," but fails to note that patients who were fused improved more with surgery on multiple outcome measures including ODI, physical function, bodily pain despite similar baseline characteristics, confounding the back pain outcomes as an isolated finding. In both the fusion and non-fusion groups, multiple univariate predictors of treatment effect have been identified that do not include back pain.3,4 Taken as a whole, the results from multiple publications of the SPORT data show that Evidence Street's attempt to isolate predominant back pain as a primary diagnostic criterion for fusion is misguided. The actual clinical reality is more nuanced.

With regards to the Inose study described on page 3 of the ES evidence summary.
As ES noted the sample size is very small and further distributed between three treatments yielding group sizes of approximately 20 patients. The study was limited to only for one level LSS and excluded patients with foraminal stenosis. Additionally, no baseline clinical data is provided to be able to assess the severity of the LSS in these patients. For these reasons, we would suggest caution in over-interpreting this clinical report.

**General comment of the ES evidence review**
In general, we would like to comment that when reviewing the evidence for the treatment of LSS is important to understand the extent of baseline pain and disability of the patient populations, rather than if they have spondylolisthesis or not. The type of treatment and the response
to treatment is very dependent on the extent of stenosis and the severity of the symptoms. An LSS patient who has mild stenosis and solitary leg pain and a modest ODI (<40) can be treated with a simple decompression whereas a moderate to severe stenotic patient with a high ODI (>60) would require a more extensive decompression which usually requires some concomitant stabilization (fusion or ILS). For example, your Evidence Review cites two pieces of literature that question the use of fusion as an effective treatment for LSS and therefore question if it is an appropriate comparator for the ILS studies; the Forsth and Ghogawala studies. This is an apples and oranges comparison. Both of these studies enrolled patients with far less severe disease and disability than the patients in the Davis study. The Forsth and Ghogawala studies did not have a minimum ODI as part of the patient inclusion criteria. This resulted in a patient population in both studies with significantly less severe disease than those in the Davis publication. The average patient in the Forsth and Ghogawala studies (ODI=42/100, 37/100 respectively) would not have been enrollable in either the Davis or the Schmidt clinical trials which had ODI inclusion criteria of a minimum of 40/100 and an actual baseline average of Davis=61/100 and Schmidt=53/100. The patients in the Forsth and Ghogawala studies are not the typical LSS patient that would be candidates for decompression with fusion and it is not surprising that decompression alone in those patients did as well as the fusion patients.

On page 9 of the ES evidence summary under the coflex device (Interlaminar) heading there is a review of the Moojen study. We feel it is inappropriate to cite or highlight this study as it severely biases against ILS devices. The US FDA labels and IDE trials for current and previous interspinous process (ISP) devices are for implantation without direct surgical decompression (i.e. stand-alone). The US FDA label and IDE trial for the Interlaminar Stabilization (ILS) device is for implantation with direct surgical decompression. These devices are biomechanically different, have different mechanisms of action and are intended for distinctly different patient populations with significant differences in disease profile. ISP devices are placed between the spinous processes with their only point of contact being the spinous process. ILS devices although also placed between the spinous processes their main point of contact and fixation is on the lamina.

ISASS has a Coverage Recommendation, issued November 2016, that is applicable to ILS devices and is silent on the ISP devices. Please note that NASS also has two separate payer coverage policies, one covering ISP devices, issued in May 2014 and the other covering ILS devices, issued in May 2018.

Evidence Street is blurring the distinction between these devices by citing of an off-label use study which has no relevance to ILS clinical evidence and coverage recommendations. Moojen et al. reported on a study of coflex, used off-label, specifically being used as an ISP without a direct decompression and not as an ILS is intended to be used with direct decompression. As would be expected the Moojen study yielded unfavorable results. It is not surprising that any device used outside its intended use would not perform as expected. The use of ILS in the Moojen study is not consistent with the FDA Approved Indications for Use for coflex, the only ILS available in the United States. ISASS gave ES this specific feedback on this point in a previous review in March 2018 which apparently has been ignored. In order to avoid confusion in the Indications for Use of ILS devices, due to the inappropriate use in the Moojen study, we would recommend it be removed from the ES evidence review or at a minimum be disclaimed as to the off-label use.

In the introductory paragraph headed INTERLAMINAR STABILIZATION DEVICES USED WITH SPINAL DECOMPRESSION SURGERY, page 11, the symptom of "predominant back pain" appears again.

The ILS patient described in the Population category of the PICO would not normally have predominant back pain. Significant back pain many times is a component of the patient's presentation but if the primary disease was LSS we would not expect back pain to be the predominant symptom. The predominant symptoms would be the classic LSS symptoms of leg and buttock pain, neurogenic claudication with or without back pain. A patient with predominant back pain would have a differential diagnosis which included Degenerative Disc Disease (DDD).

Also on page 11, under the heading CLINICAL CONTEXT AND THERAPY PURPOSE, the first sentence states: "Coflex is not intended for patients who are not candidates for lumbar decompression or decompression with fusion".
We feel this is a very misleading statement. It would be more clinically accurate and less misleading to state that: coflex is not intended for ALL patients who are not candidates for lumbar decompression or decompression with fusion. It is shortsighted to think of all LSS patients only fitting into the decompression alone or the decompression with fusion categories. There are patients whom coflex is ideally suited who are too severe (pain, function, instability) for decompression alone but not severe enough to require a decompression with fusion. This is the ideal coflex patient, allowing a decompression while providing stabilization without having to go to the extreme highly invasive fusion surgery. Coflex provides the opportunity to avoid the extreme binary treatment for LSS that you are describing and allow an intermediate treatment for a subset of patients.

Further on this page, in the PICO, under the category PATIENTS, again the introduction of the "predominant back pain" is a new insertion which as described above makes no clinical sense and defies the designs of the studies used as evidence in this review.

The statement is made "The clinical feature that best distinguishes the target population for coflex is the severity of back pain, specifically, back pain that is worse than leg pain". We do not feel this is an accurate statement. The ideal coflex patient may have significant back pain that is concomitant with the other classic LSS symptoms such as leg/buttock pain, neurogenic claudication, relief on postural flexion and MRI evidence of central, lateral and foraminal stenosis. There is no requirement for the back pain to exceed the leg pain. Reviewing the baseline data from the Davis publication of the U.S. IDE PRCT clinical trial it can be seen from the Inclusion criteria there was no requirement for back pain to be greater than leg pain for inclusion in the study. VAS back pain was required to be minimum 50/100 but no requirement for back pain to be greater than leg pain. Again if back pain were required to be greater than leg pain it would be defining a patient population more typical of DDD than LSS. The actual data from the study shows that the VAS back and VAS leg pain scores for patients were on average, nominally the same.

On page 12 under the OUTCOMES section, we would also suggest including Composite Clinical Success (CCS) under outcomes. We believe the CCS outcomes which consider several aspects of a patient's outcome, (ODI, the need for subsequent intervention, neurologic status, and adverse events) gives a more meaningful assessment of the net health benefit of an intervention. Looking at these outcomes individually can give a myopic and skewed perspective on a patient's clinical outcome. For example, how do you assess net health benefit if a patient has had a good ODI outcome at 2 years but has had a subsequent surgery or 3 epidural injections in the interim period? Or if a patient has had a major improvement in leg pain but suffers from a neurologic drop foot. Or if at 2 years the ODI has improved but immediately post-surgery they had several months of treatment for an adverse event? Using a CCS that combine these possibilities in a robust endpoint and gives the clearest evidence of a net health benefit when comparing two treatments.

Under the SETTING heading also on page 12, the setting is described as "inpatient". One of the big advantages of ILS surgery particularly considering the age of the LSS population is the ability to perform the surgery in the outpatient or ASC setting. The outpatient setting can be much less stressful for these patients and usually implies a shorter anesthesia time, again which is critical for this aged population. Outpatient setting also provides less exposure to nosocomial infections which in many cases is life-threatening for the older patient.

Under the heading COFLEX DEVICE PLUS DECOMPRESSION VS DECOMPRESSION PLUS POSTEROLATERAL FUSION on page 12, first paragraph the coflex indication is stated as "patients who have stenosis, significant back pain, and up to grade 1 spondylolisthesis". This is generally correct but it potentially wrongly implies that the patients must have a spondylolisthesis up to grade 1. The authors reported that 46% of the patients had a spondylolisthesis while 54% did not.

Also in this section, you note a 14% incidence of spinous process fractures but fail to report the comparison to the fusion group which had an 11.9% spinous fracture rate which puts the 14% in clinical perspective.
In Table 8 on page 12 the Participants column indicates N=344, Active N=262, and Comparator N=136. These are different "N's" then you report in the paragraph above. It appears by review of the SSED that the text in the paragraph is correct.

On page 13 you note "The major weakness in this trial was its use of lumbar spinal fusion as a comparator".

We disagree that fusion is not an appropriate comparator for this study and population.

The Davis publication, which was conducted using fusion as the control group is considered by ISASS, our surgeon membership and other spine specialty societies as a landmark study. It was a multi-center, long-term (5 years) PRCT with a large number of patients that we consider the most compelling evidence for the clinical benefit of the ILS treatment. Conversely, your Evidence Review concludes that this study cannot be considered or at best discounted, on what is a critical piece of ILS clinical evidence.

Rather than conclude based on the 5-year clinical outcomes data that coflex in combination with direct decompression yields a net health benefit, your Evidence Review has questioned whether decompression with fusion is an established treatment and thus whether it was an appropriate comparator to coflex. As practicing spine surgeons we do not understand, based on all available clinical and coverage information on LSS, how Evidence Street came to this conclusion. Decompression with fusion is a widely recognized and well-established treatment for a subset of LSS patients.

Interestingly, and to our knowledge, decompression with spinal fusion for LSS is widely covered by all major commercial insurance providers including BCBS. Additionally, decompression with fusion for certain LSS patients is supported by the Coverage Policy Recommendations from the major spine specialty societies, the North American Spine Society (NASS), the American Association of Neurological Surgeons/Congress of Neurological Surgeons (AANS/CNS) and the International Society for the Advancement of Spine Surgery (ISASS).

There is little clinical or practical rationale for not accepting decompression with fusion as an accepted treatment for LSS patients. The draft Evidence Review cites two pieces of literature that question the use of fusion as a comparator; the Forsth and Ghogawala studies. This is an apples and oranges comparison. Both studies enrolled patients with far less severe disease and disability than the patients in the Davis study. These studies did not have a minimum ODI as part of the patient inclusion criteria. This resulted in a patient population in both studies with significantly less severe disease than those in the Davis publication. The average patient in the Forsth and Ghogawala studies (ODI=42/100, 37/100 respectively) would not have been enrollable in either the Davis or the Schmidt clinical trials which had ODI inclusion criteria of a minimum of 40/100 and an actual baseline average of (Davis=61/100, Schmidt=53/100). The patients in the Forsth and Ghogawala studies are not the typical LSS patient that would be a candidate for decompression with fusion and it is not surprising that the decompression alone patients in those studies did as well as the fusion patients.

Another study design issue in these two studies is that the decompression and the decompression plus fusion surgical technique were not pre-specified or standardized. The Forsth study allowed surgeons to solely determine the decompression and decompression plus fusion procedures that would be performed without including any description of the procedures nor any stratification in the results of the various surgical techniques utilized. This likely had a large effect on the outcomes as various fusion techniques can have an impact on the degree of decompression that can be performed resulting in differences in outcome.

The Davis study had a primary endpoint of composite clinical success (CCS) which included four individual safety and efficacy endpoints, ODI improvement (15pt), no significant adverse events, no subsequent interventions, and neurological maintenance or improvement. In order for a patient to be a success, the patient had to be successful in all four endpoints. CCS has become the standard for large PRCTs. It is preferred over a single success endpoint as it measures a patient's outcome for multiple criteria. For example, if the sole criteria for success were ODI improvement and a patient had a 15 point ODI improvement but also exhibited neurologic deterioration, this patient would erroneously be considered a success. In a CCS endpoint study, this patient would be correctly considered a failure due to not maintaining neurologic status. An additional advantage of utilizing a CCS as the success endpoint in a clinical trial is that it is a practical way of handling the survivorship bias
that usually exists in these studies. In these studies, there are times when patients receive intervention subsequent to the initially assigned surgical treatment (subsequent intervention) i.e. epidural steroid injections or additional surgery. Without utilizing a CCS it is difficult to account for the outcomes at the final endpoint for these patients. If they have a subsequent intervention it is not appropriate to take for example their 24-month ODI score knowing that it does not represent the result of the primary treatment but rather is confounded by the subsequent intervention. By using a CCS that included subsequent intervention as a study failure would prevent all data collected after the subsequent intervention from confounding the patient's data who have survived to the terminal time-point without subsequent intervention.

The use of CCS as study success criteria is a comprehensive and robust methodology. By contrast, the Forsth and Ghogawala studies each had only a single success endpoint (for Forsth, ODI and Ghogawala, SF-36 PCS). Additionally, in these studies, there is no description in the publications as to how the primary endpoint (ODI or SF-36 PCS) was calculated at the terminal 24 months for the patients that received subsequent interventions.

Using these two studies as evidence that decompression plus fusion is not an appropriate treatment for a subset of LSS patients is overreaching from the clinician's perspective and could withhold the clinically-appropriate treatment to many LSS patients. For these reasons, we believe decompression plus fusion is an accepted treatment for LSS patients and therefore an appropriate comparator to assess the net health benefit of an ILS treatment.

Additionally, we find it troubling that you fail to apply the same rigorous criticisms to the two studies mentioned above and other studies used as counter-evidence throughout your review that you apply to the studies conducted with the ILS device.

In sum, Evidence Street's negative opinion concerning the evidentiary support for coflex's net health benefit depends first upon disqualifying the rigorous Level I PRCT PMA approved by the FDA that utilized decompression with fusion as the established alternative for the relevant population. It further depends upon disregarding that decompression with fusion is widely recognized by government agencies, Spine Specialty Societies, expert physicians, commercial insurers, and other health care stakeholders as a medically necessary and effective treatment for a subset of LSS patients. It requires doing so based on two studies that do not represent the intended population, that are methodologically flawed, and that fail to meet FDA's or Evidence Street standards for the evaluation of evidence.

In the last sentence on page 13, which states "In addition, the underlying premise that patients with back pain and spinal stenosis do not respond well to decompression (alone or followed by non-surgical treatments for back pain) has been challenged" is inconsistent with spine clinical knowledge and practice and not substantiated with a reference. We would also reiterate that to discuss in these general terms LSS patients without clinically defining where they are on the disease continuum (mild to severe) makes it difficult and adds confusion to the broad conclusions you are drawing.

On page 14 you indicate that the non-spondylolisthesis group analysis from the U.S. IDE PRCTIDE Study has not been published. In fact has been published: Spinal Stenosis in the Absence of Spondylolisthesis: Can Interlaminar Stabilization at Single and Multiple-levels Provide Sustainable Relief? International Journal of Spine Surgery, Vol. 12, No. 1, 2018, pp. 64-69.

On page 14 the review states: "Another gap in evidence, not listed in the gaps table, is that other published evidence about the use of coflex as an alternative to fusion is sparse. The results of a single randomized trial do not always correspond with the rates of treatment response, complications, and reoperations in actual practice." We find this statement perplexing, particularly in the area of spine. These are very difficult and challenging trials to conduct. We should encourage this level of clinical evidence commitment with a large and long-term clinical trial. It would be welcome if all devices being used in spine had such rigorous clinical evidence. We would also point out that many of the products that have received coverage recommendations from ES have an equal evidentiary basis as coflex, (i.e. Minimally Invasive SI Joint Fusion).

With regards to Table 10 on page 14 Relevance limitations: We have the same comments made relative to fusion as an appropriate comparator as above.
With regards to Table 11 on page 14 Study Design and Conduct limitations, under Allocation 3. Allocation Concealment Unclear. In a review of the SSSED study arm allocation was specified stating "The study was a prospective, randomized, multicenter, concurrently controlled clinical study. Surgeons were blinded prior to patient randomization, and patients were blinded until after surgery".

With regards to Table 11 on page 14 Study Design and Conduct limitations, under Blinding 4. "No independent adjudication or preset criteria for subsequent intervention". We do not feel the use of independent blinded adjudication presents a potential surgeon bias in this study and a priori objective criteria would not have been possible in this study or any study of this type. In this study, the protocol with regards to subsequent intervention study reflects the usual and customary practice of clinical medicine, including the treatment of recurrent intractable pain or neurologic deterioration. It is not clinically realistic or real-world that a list of preset criteria could account for all the possible clinical circumstances that could be encountered when contemplating a subsequent treatment for a patient who has recurrent pain or a deteriorating neurologic condition.

It is reasonable to believe that a treating surgeon would not consider performing a subsequent intervention in consultation with a patient unless it was absolutely necessary. Any other inference would suggest that spine surgeons are willing to perform an unnecessary procedure in order to bias the outcome of a study, frankly an absurd proposition.

Additionally, when looking at the reoperation rates of this study, specifically, the Adverse Events and Secondary Surgical Procedures section on page 1535 of the publication it can be seen that the authors state that 10.7% (23/215) and 7.5% (8/115)1) were the reoperation rates for coflex and fusion respectively. This indicates a higher reoperation rate for coflex compared to fusion, which if you suspected a surgeon bias would only be biased against coflex.

In our opinion the use of independent blinded adjudication and a priori objective criteria is ethically and practically not possible in these types of studies and based on the data does not suggest any surgeon bias related to subsequent interventions was introduced in favor of ILS.

On page 15 under Subsection summary, ES again discounts fusion and subsequently discounts the entire IDE/PMA clinical as an appropriate comparator on the basis that 2 RCTs (Forsth and Ghogawala) showed no difference in ODI scores between decompression alone and decompression with fusion. We reiterate as above our position that these studies, due to the study design and statistical flaws do not serve as a credible basis to discount decompression with fusion as an appropriate LSS treatment for this population. Among the other issues discussed, the SSSS trial used a 12-point ODI difference as the study's primary endpoint. Besides being a solitary endpoint, which has the disadvantages relative to CCS, already discussed the use of 12 point ODI difference in lieu of a 15 point ODI difference is highly unusual and possibly unprecedented in spine clinical trials. On page 1416 of the publication, the authors even state that "We chose a difference of 12 conservatively since a decrease in the ODI score of 15 had been suggested by the Food and Drug Administration to indicate minimally important improvement after spinal fusion surgery". ES emphasizes that the study was powered to detect a 12 point ODI difference but it is interesting to note that if the more usual and accepted 15 point ODI difference was used the study would be underpowered. It is unclear whether the 12 point ODI difference was prescribed a priori or was it a posthoc analysis to insure adequate power in the study. Regardless, using a 12 point ODI difference in lieu of the accepted 15 point lowers the success bar and biases the study outcome in favor of the more conservative procedure. Combined with the fact that based on the low baseline ODI scores, the patients in these 2 studies had only mild LSS and would not have even met the enrollment inclusion criteria of the more severe LSS disease in the coflex PMA study.

Regarding the ES review of the coflex device plus decompression versus decompression alone:

On page 17 of the ES coflex evidence summary Table 14. Relevance limitations under the category Comparator it is stated: "In the control arm, nonsurgical treatment for back pain after decompression should be described." The patients in this trial have already been shown to have failed conservative care for a minimum of 3 months. It does not make clinical sense that after the initial surgery to then put the patient thru another course of non-surgical treatment. Recurrence of pain after the initial procedure is an indication that the primary surgery has failed. It is unlikely that a patient that has recurrent pain after their initial treatment is
going to respond to additional conservative care, and even if they did it would still indicate a failure of the initial surgical treatment and their 24-month outcome could not be attributed solely to the initial treatment.

On page 17 of the ES coflex evidence summary Table 14. Relevance limitations under the category Outcomes it is stated: "No CONSORT reporting of harms". Although not in CONSORT format the authors do describe Adverse Events in the publication that show no significant differences between groups.

Regarding Table 15. Study Design and Conduct limitations under the Blinding category it is stated that: "Not blinded to treatment assignment".

The Schmidt article clearly states that the study was randomized and the surgeon and patient did not know the treatment assignment until the time of surgery. Therefore it is unclear why "not blinded to treatment assignment" would be considered a limitation in this study.

Additionally, in Table 15, under the Blinding category, it is stated that "No independent adjudication or preset criteria for subsequent intervention". We offer the same comment for this proposed limitation as that described in our comments on ES Table 11 regarding the coflex versus fusion PMA study.

Table 15 indicates a limitation under Data Completeness indicating a high loss to follow-up, use of LOCF, no intent to treat analysis and power not calculated for primary outcome.

We disagree with the statement that this study has a high loss to follow-up. We believe this is a misrepresentation or misunderstanding by ES of the study design and data presentation. The authors state that "the analysis set (mitt) consisted of 225 patients" which "at 24 months 204 patients were evaluable for analysis representing an overall 91% follow-up rate".

Also, ES states that: "LOCF" may not be the most appropriate approach for missing data".

We do not see any reference or discussion of an LOCF analysis in the Schmidt publication, therefore, we are unsure of the source of this comment.

Evidence Street states that power was not calculated for primary outcome.

The Schmidt authors include a discussion on statistical analysis which includes the power calculation and rationale.

On page 17 of the ES review, it is stated that: "The inclusion of epidural and facet joint injections in the endpoint may be inappropriate in this trial."

Admittedly, in clinical practice, there are scenarios although not ideal, where a surgeon may need to perform an epidural steroid injection to assist a patient through an ongoing or recurrent pain episode. But in the case of performing a clinical trial, in order to objectively compare two surgical treatments and to develop the most clinically meaningful scientific evidence, we believe epidural injections should be used as a study endpoint. A surgical treatment that required fewer post-operative epidural(s) to be successful in the long-term would be considered clinically superior to one that required post-operative epidurals to maintain pain relief. This outcome data is important clinical information for a surgeon in which to choose between two surgical treatments. Therefore, a clinical trial study design for stenosis that classified an epidural as a patient failure is a preferred protocol. It gives the surgeon a true picture of what outcomes to expect when utilizing either of the two surgical treatments. It would be misleading to report two-year outcomes in a study, without being clear that to achieve those outcomes it required subsequent interventions (including epidural injections). Additionally, the fact that the same criteria (epidural constitutes a failure) are used for both study arms, does not inherently bias the study towards one or the other treatment. For these reasons, in clinical trials, we consider the use of a post-operative epidural as a patient failure appropriate.
With regards to the Schmidt study, there are some findings not in the primary endpoint that are clinically important. First, is the finding that the ILS group showed a 5x improvement in walking distance compared to decompression alone patients which had a 2x improvement. For many patients, the ability to walk is their primary presenting complaint and restoring their ability to walk leads to significant patient satisfaction. This is particularly important in the aged LSS patient population in that immobility can lead to and exacerbate other comorbidities. Secondly, the ILS group had a decreased need for compensatory pain management (opioids) at every time point. Currently, the elderly are the fastest-growing demographic identified in the "opioid epidemic" and anything a surgeon can do to decrease opioid use is significant.

Interspinous devices may have short term benefits, with shorter hospital stays. These benefits, however, are outweighed with the need for additional surgery, exceeding that in patients undergoing decompression without such devices. These conclusions are consistent across several peer-reviewed publications.

Per the section above, the limitations of these devices appear so significant, compared to more standard surgical treatment approaches that we do not use them.

Clinically, these devices have utility in patients that do not want to consider decompression and fusion, or those that cannot move forward with general anesthesia.

NR = not reported

5. Is there any evidence missing from the attached draft review of evidence that demonstrates clinically meaningful improvement in net health outcome?

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Documentation for Clinical Review

- No records required

Coding

This Policy relates only to the services or supplies described herein. Benefits may vary according to product design; therefore, contract language should be reviewed before applying the terms of the Policy. Inclusion or exclusion of codes does not constitute or imply member coverage or provider reimbursement.

IE

The following services may be considered investigational.

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### Definitions of Decision Determinations

**Medically Necessary:** A treatment, procedure, or drug is medically necessary only when it has been established as safe and effective for the particular symptoms or diagnosis, is not investigational or experimental, is not being provided primarily for the convenience of the patient or the provider, and is provided at the most appropriate level to treat the condition.

**Investigational/Experimental:** A treatment, procedure, or drug is investigational when it has not been recognized as safe and effective for use in treating the particular condition in accordance with generally accepted professional medical standards. This includes services where approval by the federal or state governmental is required prior to use, but has not yet been granted.

**Split Evaluation:** Blue Shield of California/Blue Shield of California Life & Health Insurance Company (Blue Shield) policy review can result in a split evaluation, where a treatment, procedure, or drug will be considered to be investigational for certain indications or conditions, but will be deemed safe and effective for other indications or conditions, and therefore potentially medically necessary in those instances.

### Prior Authorization Requirements (as applicable to your plan)

Within five days before the actual date of service, the provider must confirm with Blue Shield that the member's health plan coverage is still in effect. Blue Shield reserves the right to revoke an
authorization prior to services being rendered based on cancellation of the member's eligibility. Final determination of benefits will be made after review of the claim for limitations or exclusions.

Questions regarding the applicability of this policy should be directed to the Prior Authorization Department. Please call (800) 541-6652 or visit the provider portal at www.blueshieldca.com/provider.

Disclaimer: This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. Blue Shield of California may consider published peer-reviewed scientific literature, national guidelines, and local standards of practice in developing its medical policy. Federal and state law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over medical policy and must be considered first in determining covered services. Member contracts may differ in their benefits. Blue Shield reserves the right to review and update policies as appropriate.