The chapter on the spine includes how impairments impact on an individual’s activities of daily living.

Impairments of the spine include:
1. Cervical
2. Thoracic
3. Lumbar
4. Spinal Cord
5. Pelvis

The changes made for the 5th edition of the “Guides” include:
1. Modification of the ROM and DRE methods
2. Impairment is rated only at MMI
3. Impairments within a DRE category encompass a range, with adjustments of up to 3%
4. Spinal cord injuries are evaluated according to the functional approach in the nervous system chapter
5. The “differentiators” used in the 4th edition are replaced by “objective findings”

6. Alteration of motion segment integrity (AOMSI) have been redefined

-“The DRE method is the primary method used to evaluate individual’s with an injury.”
-“Use the ROM method when the impairment is not caused by an injury or when an individual’s condition is not well represented by a DRE category.”
-“The ROM method is also now used to evaluate individual’s with an injury at more than one level in the same spinal region and in certain individual’s with recurrent pathology.”
The 5th edition of the “Guides” has given the evaluator more latitude in the evaluation of a physical impairment. 

Opinion, in this edition, plays a much larger role that previous editions.

**DOCUMENTATION AND RECORDKEEPING ARE STRESSED!**

“Certain conditions that may be controlled by medications or treatment and may be in total remission, may have the final impairment estimate or value increased by a small percentage (1%-3%) combining that percent with all other impairments.” (pg. 20)

“If for any reason the patient declines therapy, treatment, or surgery for a permanent impairment, that decision should not affect the estimated percentage of his or her impairment”.

Since pain is usually included in the rating percentage, do not include it a second time.
Diagnostic tests such as x-rays, MRI’s, CT’s, etc. should only be done if necessary and relevant.

The 5\textsuperscript{th} edition of the “Guides” continues to use two methods to evaluate spinal impairments:

1. “Injury Model” (Diagnosis Related Estimates) (DRE)
   a. Cervical
   b. Thoracic
   c. Lumbosacral

2. “Range of Motion Model” (Functional Method)
   a. Cervical
   b. Thoracic
   c. Lumbosacral

\textbf{NOTE: Do not use both methods in making the final impairment estimate.}
SPECIAL NOTE:

REPEAT: The method of choice for evaluating the spine is the Injury Model (DRE).

As an example, if a patient has a herniated disc with nerve root irritation, the DRE is the way to determine the impairment.

If the patient does not fit into any of the categories within the DRE’s, then you would move to the Range of Motion Model.

NOTE: The Range of Motion Model is the court of last resort.

NOTE: Although there are eight categories in the DRE method, almost all individuals will fall into one of the first three DRE categories.
There are two approaches to assigning a patient to a DRE category:

1. Based on symptoms, signs, and appropriate diagnostic test results.
2. Based on the presence of fractures and/or disc dislocations with or without clinical symptoms.

If a fracture is present that places the individual into a DRE category, no other verification is required (Box 15-1, pg. 382)
Definition of Clinical Findings:
1. Muscle Spasm
2. Muscle Guarding
3. Asymmetry of Spinal Motion
4. Nonverifiable Radicular Root Pain
5. Reflexes
6. Weakness and Loss of Sensation
7. Atrophy
8. Radiculopathy
9. Electrodiagnostic Verification of Radiculopathy
10. Alteration of Motion Segment Integrity
11. Cauda Equina Syndrome
12. Urodynamic Tests

**IF**, a patient cannot be assigned to a DRE category, look to Range of Motion.

With the Range of Motion Model, use impairment values in the Spinal Disorders table (15-7), and combine them with values obtained from the patient’s range of motion, neurological deficits, and values from the other organ systems involved.
Instructions:
1. Use this table only when using ROM method.
2. Identify the most significant diagnosis of the primary involved region.
3. The diagnosis based impairment percent should be combined with ROM impairment estimates and whole person impairment estimates involving sensation, weakness, and other conditions.
4. Combine the diagnosis based, range of motion, and other whole person impairment estimates using the Spine Impairment Summary form (Table 15-20)
5. Repeat for other involved spine regions and combine regional impairments.
Spinal Fractures:

Compression Fractures:

• Certain types of fractures are assigned specific values.
• Since compression fractures impact on function differently in different areas of the spine, they are assigned specific numbers. (tbl.15-17)
• Compression fractures are assigned impairments depending on the area, and the percentage of compression.

Table 15-7 Criteria for Rating Whole Person Impairment Percent Due to Specific Disorders to be used as part of the ROM method

<table>
<thead>
<tr>
<th>Disorder</th>
<th>%Impairment of Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cervical</td>
</tr>
<tr>
<td>1. Fractures</td>
<td></td>
</tr>
<tr>
<td>A. Compression of one vertebral body</td>
<td></td>
</tr>
<tr>
<td>0% - 25%</td>
<td>4</td>
</tr>
<tr>
<td>26% - 50%</td>
<td>8</td>
</tr>
<tr>
<td>Above 50%</td>
<td>10</td>
</tr>
</tbody>
</table>
Pre-existing Compression Fractures:

If a patient has a pre-existing compression fracture with residuals, and then has another injury to the same area, the pre-existing compression fracture should be included in the final impairment rating.

Although the pre-existing compression fracture is included in the rating, it must be **apportioned** out, in your final report, that there was pre-existing compression fracture and that the current accident or injury caused an aggravation of the pre-existing fracture.

**Example:**

Permanent impairment to the Whole Person: 20%
Pre-existing 40% compression fracture of L3: 7%
Accident of June 15, 2011 = 13%

**NOTE:** MULTIPLE COMPRESSION FRACTURES ARE COMBINED
Posterior Element Fractures:

For the purposes of impairment ratings, the posterior elements are defined as:
- Pedicles
- Laminae
- Articular Processes
- Transverse Processes

**NOTE:** The spinous process is not included because a fracture at that site does not usually impede function. If pain or muscle weakness are present, and impair function, then it should be evaluated by sensory or motor impairment ratings.

Several fractures of the posterior elements of one vertebra are rated as a single fracture.
Fractures of the posterior elements in multiple vertebrae are combined.
**Spinal Fractures:**

*Posterior Element Fractures:*

Table 15-7 Criteria for Rating Whole Person Impairment Percent Due to Specific Disorders to be used as part of the ROM method

<table>
<thead>
<tr>
<th>Disorder</th>
<th>%Impairment of Whole Person</th>
<th>Cervical</th>
<th>Thoracic</th>
<th>Lumbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fractures</td>
<td></td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>B. Fracture of posterior elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(pedicle, lamina, articular process,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>transverse process)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: An impairment due to compression of a vertebrae and one due to fracture of a posterior element are combined using the Combined Values chart. (Pg. 604). Fractures of compression of several vertebrae are combined.
As with other chapters in the “Guides”, an evaluation should include:

1. An accurate medical history
2. A review of all pertinent records
3. A comprehensive description of the individual’s current symptoms and their relationship to activities of daily living
4. Results of a physical examination
5. All diagnostic test results (x-ray, MRI, CT, EMG, Labs, etc.)
6. All calculations used to determine the impairment
Spinal Measurement:

• Although the **goniometer** has been used for spinal measurement, it is no longer being used.

• The appropriate instrument for spinal measurement is the **Inclinometer**.

• Factors such as angle of kyphosis of the thoracic spine and the sacral (hip) angle now are important in obtaining exact measurements.

• Repetition of measurements must be performed **three times** in order to be valid.
  - All measurements must fall between 10% or 5 degrees of each other.
Using the Inclinometer:

The inclinometer is used for each plane of movement in the spine.

NOTE:

• Calculate the mean or average of the three.

• If the average is less than 50 degree, three consecutive measurements must fall within 5 degrees of the mean: if the average is greater than 50 degrees, three consecutive measurements must fall within 10% of the mean.” (pg. 399)

In some cases such as lumbosacral flexion/extension, additional measurement of the straight leg raising test must also correlate with the findings.
Procedure:

• Inclinometer measurement is obtained for each movement.
• The number of degrees is located in the first large column.
• Move across the chart to the fourth column to find the percentage of impairment for that measurement.

| 30° | 2 |

• This procedure is repeated for each motion.
• When all of the figures for range of motion within a single area is determined, the numbers are added.
• Once you get all numbers for the same area added, you combine the different areas to arrive at a single impairment for the spine.
Using the Inclinometer:

**Cervical Spine** (measured sitting or standing)

**Flexion/Extension**
- Mark and zero inclinometers at T1 and occiput (sagittal plane).
- Have patient flex maximally and record both angles.
- Subtract T1 from occipital reading to obtain cervical flexion.
- Zero again.
- Have the patient extend the neck and record both angles.
- Subtract T1 from occiput reading to obtain cervical extension.
The subject is either sitting or standing with the head in the neutral position, with inclinometers over the occiput and T1.

With the subject in full flexion position, subtract the angle at the lower inclinometer from the upper inclinometer to obtain the cervical flexion angle.

Subtract the T1 inclinometer angle from the occipital angle to obtain the extension angle.

Alternative placement of lower inclinometer when extension motion is so great as to displace inclinometer over T1. Use skin mark for placement over the scapular spine.
**Lateral Flexion**

- Mark and zero inclinometer at T1 and occiput (coronal plane).
- Have patient laterally flex to the left and record both angles.
- Subtract T1 from occipital reading to obtain left lateral flexion.
- Zero again.
- Repeat procedure for the right side.
**Rotation** (Patient in reclined supine position – use one inclinometer)

- Place the inclinometer near the back of the head in line with the cervico-occipital junction.
- Zero out with patient’s nose pointing toward the ceiling.
- Patient rotates head to right and record angle of rotation.
- Zero again.
- Patient rotates head to the left and record angle of rotation.
- Add values for total rotation.
### FLEXION/EXTENSION

#### Flexion From Neutral Position

<table>
<thead>
<tr>
<th>Degrees of Cervical Motion</th>
<th>% Impairment of Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost</td>
<td>Retained</td>
</tr>
<tr>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Extension From Neutral Position

<table>
<thead>
<tr>
<th>Degrees of Thoracic Motion</th>
<th>% Impairment of Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost</td>
<td>Retained</td>
</tr>
<tr>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Region Anklyosed (Flexion)

<table>
<thead>
<tr>
<th>Region Anklyosed at (*):</th>
<th>% Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (neutral position)</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>50 (full flexion)</td>
<td>30</td>
</tr>
</tbody>
</table>

#### Region Anklyosed (Extension)

<table>
<thead>
<tr>
<th>Region Anklyosed at (*):</th>
<th>% Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (neutral position)</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>60 (full extension)</td>
<td>40</td>
</tr>
</tbody>
</table>

---

**Table 15-12** Cervical Region Impairment From Abnormal Flexion or Extension or Ankylosis

Abnormal Motion
Average range of flexion and extension is 110°; the proportion of all cervical motions is 40°.
### Abnormal Motions:
Average range of flexion and extension is 110 degrees, the proportion of all cervical motion is 40%

#### a. Flexion from Neutral Position (0) to (*)

<table>
<thead>
<tr>
<th>Degree of Cervical Motion Lost</th>
<th>Degree of Cervical Motion Retained</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### b. Extension from Neutral Position (0) to (*)

<table>
<thead>
<tr>
<th>Degree of Cervical Motion Lost</th>
<th>Degree of Cervical Motion Retained</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>60</td>
<td>6</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>40</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Example:

Case History:

An individual was involved in a motor vehicle accident. After a period of treatment, it was determined that the patient was at MMI, and that ongoing treatment was not indicated. As a result of the injuries the patient was left with the following residual problems:

Cervical Flexion: 30 degrees  
Thoracic Flexion: 30 degrees  
Cervical Extension 40 degrees  
Thoracic Right Rotation: 20 degrees  
Cervical Right Rotation 40 degrees  
C6 Disc Syndrome with unoperated herniated nucleus pulposus, and 60% compression fracture of C5
Solution:

Cervical Range of Motion:

- Flexion 30 degrees = 2% Whole Person (tbl. 15-12)
- Extension 40 degrees = 2% Whole Person (tbl. 15-12)
- Right Rotation 40 degrees = 2% Whole Person (tbl. 15-14)

6% Whole Person (added)

Thoracic Range of Motion:

- Flexion 30 degrees = 1% Whole Person (tbl. 15-10)
- Right Rotation 20 degrees = 1% Whole Person (tbl. 15-11)

2% Whole Person (added)

6% (Cervical) combined with 2% (Thoracic) = 8% Whole Person (pg. 604)

Cervical Disc Syndrome (unoperated HNP) = 6% Whole Person (tbl. 15-7)

60% compression fracture of C5 = 10% Whole Person (tbl. 15-7)

10% (fracture) combined with 8% (ROM) = 17%

17% combined with 6% (disc) = 22% Final Whole Person Impairment
Ankylosis:

• Ankylosis is defined as the complete absence of joint motion or as a fixed position.

• Although ankylosis is rare in the spine, those patients who cannot reach the neutral or 0 degree position, the position or angle of restriction closest to the neutral position is considered to be the position of ankylosis.

• If a region has several range of motion impairments, and an ankylosis impairment, the range of motion impairments are added and the total is combined with the ankylosis impairment.

• The examiner should add the ankylosis impairments in several planes within a single region and then combine with ankylosis impairment of two or more regions.
Example:

An individual who can flex the cervical region from 30 degrees to 50 degrees and who lacks 30 degrees of motion in reaching the neutral 0 degrees position has the same estimated impairment as if he or she had ankylosis at 30 degrees of cervical flexion.

According to table 15-12, the patient’s impairment is 30% of the whole person.
Thoracic Spine (may be measured sitting or standing)

**Flexion/Extension**

Note: Flexion and extension is relatively limited with a degree of extension significantly determined by the subject’s posture and the degree of fixed “kyphosis”. Subject is measured in a “military brace” posture to obtain angle of minimum kyphosis (found in ankylosis section of table 79). Following this, the angle of thoracic flexion is obtained by flexing the thoracic spine.

1. Zero inclinometers against a true vertical surface such as a wall.
2. Mark T1 and T12 and read the inclinometers in “military brace” position.
3. Subtract T12 from T1 to get angle of minimum kyphosis.
4. Zero again.
5. Patient then flexes and the T1 and T12 angles are recorded.
6. Subtract T12 from T1 to obtain the angle of **Thoracic Flexion**.
THORACIC SPINE

2 inclinometer measurement technique for obtaining angle of minimum kyphosis.

**Standing & Sitting Techniques**

- With the inclinometer at T1 and T12 and with the subject in the erect “military brace” posture to obtain **angle of minimum kyphosis**.

- With the inclinometer over T1 and T12 and with thoracic spine maximally flexed to obtain **angle of thoracic flexion**.
### Table 15-10 Impairment Due to Abnormal Motion (Flexion) and Ankylosis of the Thoracic Region

Average range of flexion and extension is 50°; the proportion of all thoracic motion is 60% of the total spine.

<table>
<thead>
<tr>
<th>Abnormal Motion</th>
<th>Degrees of Thoracic Motion</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion from Erect Position (Angle of Thoracic Flexion) to:</td>
<td>Lost</td>
<td>Retained</td>
</tr>
<tr>
<td>0</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>35</td>
<td>15</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>50</td>
</tr>
</tbody>
</table>

Ankylosis

Angle of Minimum Kyphosis (°):

<table>
<thead>
<tr>
<th>Angle of Minimum Kyphosis (°)</th>
<th>Degree of Thoracic Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30 (Extension thoracic lordosis)</td>
<td>20</td>
</tr>
<tr>
<td>0 (neutral)</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>

**FLEXION**

- Impairment Due to Abnormal Motion (Flexion) of the Thoracic Spine
- Degree of Thoracic Motion
- % Impairment of the Whole Person
- Ankylosis
**Rotation** (measure patient in a flexed position)

1. Mark T1 and T12 points (neutral position to zero out).
2. Have patient maximally rotate to the right and record values.
3. Subtract T12 from T1 to obtain thoracic right **Rotation**.
4. Repeat procedure for left rotation.
Table 15-11  Impairment Due to Abnormal Motion and Ankylosis of the Thoracic Region: Rotation

<table>
<thead>
<tr>
<th>Abnormal Motion</th>
<th>Degrees of Thoracic Motion</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average range of motion is 60°; the proportion of all thoracic motion is 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Left Rotation From Neutral Position (0°) to (*)</td>
<td>Degrees of Thoracic Motion Lost</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>b.</td>
<td>Right Rotation From Neutral Position (0°) to (*)</td>
<td>Degrees of Thoracic Motion Lost</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>c.</td>
<td>Ankylosis Region Ankylosed at (*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 (neutral position)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 (full left or right rotation)</td>
<td></td>
</tr>
</tbody>
</table>

Left Rotation From Neutral Position
Degrees of Thoracic Motion
% Impairment of the Whole Person

Ankylosis
Lumbosacral Spine (measure standing)

Note: Lumbar flexion is a compound movement of the lumbar spine and hips (measured at the sacrum). Hip flexion actually accounts for 50% of total flexion. A comparison of hip flexion to straight leg raising on the tightest side offers a validation measure independent of reproducibility. The test is invalid and must be repeated if the following validity criterion is not met.

Tightest straight leg raising (SLR) – (hip flexion + hip extension) is within plus or minus 15 degrees.

1. Zero inclinometers over T12 and sacrum.
2. Subject flexes maximally and both angles are recorded.
3. Subtract sacral (hip) measurements from T12 measurement for true lumbar flexion angle.
4. Zero again.
5. Subject extends trunk and both angles are recorded.
6. Subtract sacral (hip) angle from T12 angle and record true lumbar extension angle.
7. Record straight leg raising (SLR) angle and compare to sacral hip motion (flexion + extension). Test must be less then 10 degrees to be valid.
2 Inclinometer measurement technique for lumbosacral flexion/extension.

Neutral position and Flexion shown with inclinometers at T12 and over the sacrum.

True lumbar extension – T12 inclination – sacral inclination (hip motion)

(d) Validity testing: Straight leg raise on the tightest side should be within 15° of the total sacral hip motion (sacral hip flexion + sacral hip extension).
<table>
<thead>
<tr>
<th>Sacral (Hip) Flexion Angle (°):</th>
<th>True Lumbar Spine Flexion Angle (°)</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>45+</td>
<td>60+</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>30-45</td>
<td>40+</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>0-29</td>
<td>30+</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>True Lumbar Spine Extension from Neutral Position (0°) to:</th>
<th>Degrees of Lumbosacral Spine Motion</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Lost</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>Retained</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
Lateral Flexion

1. Zero out inclinometers over T12 and sacrum in coronal plane.
2. Patient lateral flexes to right and both angles are recorded.
3. Subtract sacral (hip) inclination from T12 for right Lateral Flexion angle.
4. Zero again.
5. Repeat procedure to the left.
### LATERAL BENDING

**Left Lateral Bending From a Neutral Position**

<table>
<thead>
<tr>
<th>Degrees of Lumbosacral Motion</th>
<th>Lost</th>
<th>Retained</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

**Right Lateral Bending From Neutral Position (0°) to:**

<table>
<thead>
<tr>
<th>Degrees of Lumbosacral Motion</th>
<th>Lost</th>
<th>Retained</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

**Ankylosis**

Region Ankylosed at (*°*):

<table>
<thead>
<tr>
<th>Region</th>
<th>0 (neutral position)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DIAGNOSIS RELATED ESTIMATES (DRE)

Within this method of rating, there are eight diagnosis related categories.

The two methods of assigning a rating are:

1. Based on symptoms, signs, and appropriate diagnostic test results.
2. Based on the presence fractures and/or dislocations with or without clinical symptoms.

While there are eight categories listed in the DRE’s, for the most part, we will be addressing categories I, II, III.

Categories IV and V address Alteration of Motion Segment Integrity and Fractures.
<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria for Rating Impairment</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cervical</td>
</tr>
<tr>
<td>I</td>
<td>Subjective complaints or symptoms</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>No significant clinical findings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No spasms or muscle guarding</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Criteria for Rating Impairment</td>
<td>% Impairment of the Whole Person</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cervical</td>
</tr>
<tr>
<td>Minor Impairment</td>
<td>Muscle guarding or spasms at time of exam</td>
<td>5% - 8%</td>
</tr>
<tr>
<td></td>
<td>Asymmetric loss of range of motion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clinical signs of an injury</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-verifiable radicular complaints</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HNP without radicular signs following conservative treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less than 25% compression fracture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A posterior element fracture without displacement or dislocation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spinous or transverse fracture with displacement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HNP W/O RADICULOPATHY</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Criteria for Rating Impairment</td>
<td>% Impairment of the Whole Person</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cervical</td>
</tr>
<tr>
<td>III</td>
<td>Significant signs of radiculopathy or ongoing impairment of the lower extremity</td>
<td>15% - 18%</td>
</tr>
<tr>
<td></td>
<td>Pain and or sensory loss in dermatome distribution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of relevant reflexes, loss of muscle strength, or atrophy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impairment should be verified by electrodiagnostic finding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HNP with radiculopathy or surgically treated and may now be asymptomatic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25% to 50% compression fracture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Posterior element fracture with displacement disrupting the spinal canal, healed with structural alteration</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Criteria for Rating Impairment</td>
<td>% Impairment of the Whole Person</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------</td>
<td>----------------------------------</td>
</tr>
</tbody>
</table>
| Cervical | Loss of motion segment integrity from flexion and extension radiographs  
           - Cervical: at least 3.5mm of translation; 11° angular motion  
           - Thoracic: 2.5mm translation one vertebrae to another, flexion, extension radiographs; bilateral radiculopathy or involvement of more than one level  
           - Lumbar: flexion, extension radiographs at least 4.5mm of one vertebra on another or angular motion greater than 15° at L1-2, L2-3, and L3-4, greater than 20° at L4-5 and greater than 25° at L5-S1 - may be due to developmental fusion or successful or unsuccessful surgical arthrodesis  
           - More than 50% compression of one vertebral body without neural compromise | 25% - 28% | 20% - 23% | 20% - 23% |
<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria for Rating Impairment</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cervical</td>
</tr>
<tr>
<td>Cervical</td>
<td>Significant upper extremity impairment requiring the use of the UE external function or adaptive devices. There may be total neurologic loss at a single level or severe multilevel neurologic dysfunction.</td>
<td>35% - 38%</td>
</tr>
<tr>
<td>Thoracic</td>
<td>Impairment of lower extremity as defined in TL category III and loss of structural integrity as defined in thoracic category IV.</td>
<td></td>
</tr>
<tr>
<td>Lumbar</td>
<td>Criteria of DRE LS category III and IV; significant lower extremity impairment as indicated by atrophy, loss of reflexes, pain, and or sensory changes or electromyographic findings as stated in LS category III and LS category IV.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greater than 50% compression fracture of one vertebral body with unilateral neurologic compromise. Cervical and thoracic same without residual neural compromise.</td>
<td></td>
</tr>
</tbody>
</table>
Example:

A patient had a radiculopathy caused by a herniated disc that responded to conservative care and currently has no radicular symptoms or signs, That individual would be placed in Category II.

If, however, that same patient had the same findings (HNP) with a radiculopathy then they would be placed in Category III.
Clinical Findings Used to Place an Individual in a DRE Category:

1. Muscle Spasm
2. Muscle Guarding
3. Asymmetry of Spinal Motion
4. Nonverifiable Radicular Root Pain
5. Reflexes
6. Weakness and Loss of Sensation
7. Atrophy
8. Radiculopathy
9. Electrodiagnostic Verification of Radiculopathy
10. Alteration of Motion Segment Integrity
11. Cauda Equina Syndrome
12. Urodynamic Tests
# Diagnosis Related Estimates (DRE)

## Cervical Spine

### Table 15-5  Criteria for Rating Impairment Due to Cervical Disorders

<table>
<thead>
<tr>
<th>DRE Cervical Category I</th>
<th>DRE Cervical Category II</th>
<th>DRE Cervical Category III</th>
<th>DRE Cervical Category IV</th>
<th>DRE Cervical Category V</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% Impairment of the Whole Person</td>
<td>5%-8% Impairment of the Whole Person</td>
<td>15%-18% Impairment of the Whole Person</td>
<td>25%-28% Impairment of the Whole Person</td>
<td>35%-38% Impairment of the Whole Person</td>
</tr>
</tbody>
</table>

**DRE Cervical Category I**
- No significant clinical findings, no muscular guarding, no documented neurologic impairment, no significant loss of motion segment integrity, and no other indication of impairment related to injury or illness; no fractures.

**DRE Cervical Category II**
- Clinical history and examination findings are compatible with a specific injury; findings may include muscle guarding or spasm observed at the time of the examination by a physician, asymmetric loss of range of motion or nonverifiable radicular complaints, defined as complaints of radicular pain without objective findings; no alteration of the structural integrity or fractures.

**DRE Cervical Category III**
- Significant signs of radiculopathy, such as pain or sensory loss in a dermatomal distribution, loss of relevant reflex(es), loss of muscle strength, or unilateral atrophy compared with the unaffected side, measured at the same distance above or below the elbow; the neurologic impairment may be verified by electrodiagnostic findings or fractures: (1) less than 25% compression of one vertebral body; (2) posterior element fracture without dislocation that has healed without loss of structural integrity or radiculopathy; (3) a spinous or transverse process fracture with displacement.

**DRE Cervical Category IV**
- Alteration of motion segment integrity or bilateral or multilevel radiculopathy; alteration of motion segment integrity is defined from flexion and extension radiographs as at least 3.5mm of translation of one vertebra on another, or angular motion of more than 11° greater than at each adjacent level (Figures 15-3a and 15-3b); alternatively, the individual may have loss of motion of a motion segment due to a developmental fusion or successful or unsuccessful attempt at surgical arthrodesis; radiculopathy as defined in cervical category III need not be present if there is alteration of motion segment integrity or fractures: (1) more than 50% compression of one vertebral body without residual neural compromise.

**DRE Cervical Category V**
- Significant upper extremity impairment requiring the use of upper extremity external functional or adaptive device(s); there may be total neurologic loss at a single level or severe, multilevel neurologic dysfunction or fractures: structural compromise of the spinal canal is present with severe upper extremity motor and sensory deficits but without lower extremity involvement.
EXAMPLE:  CERVICAL SPINE DRE

• **Subject:**  37 year old female
• **History:**  Pain in the neck and lateral right upper extremity extending to the thumb following a rear end collision. An MRI showed a herniated disc at C6. She elected nonoperative treatment and recovered after 18 months.
• **Current Symptoms:**  Some residual neck pain with physical activity; upper limb symptoms have resolved.
• **Physical Exam:**  Slight loss of motion of the cervical spine. Neurologic examination is normal.
• **Clinical Studies:**  Initial MRI: right posterolateral disc herniation at C5. No additional imaging studies were performed.
• **Diagnosis:**  Herniated disc C5-6 with resolved right C6 radiculopathy.
• **Impairment Rating:**  5% WP

**Comment:** The individual qualifies for DRE cervical category II because she had a radiculopathy caused by a herniated disc that responded to treatment. She has no significant residual signs.
## Diagnosis Related Estimates (DRE)  
**Thoracic Spine**

<table>
<thead>
<tr>
<th>DRE Thoracic Category</th>
<th>Criteria for Rating Impairment Due to Thoracic Spine Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 0% Impairment of the Whole Person</td>
<td>No significant clinical findings, no observed muscle guarding, no documented changes in structural integrity, and no other indication of impairment related to injury or illness; no fractures.</td>
</tr>
<tr>
<td>II 5%-8% Impairment of the Whole Person</td>
<td>History and examination findings are compatible with a specific injury or illness; findings may include significant muscle guarding or spasm observed at the time of the examination, asymmetric loss of range of motion (dysmetria), or nonverifiable radicular complaints, defined as complaints of radicular pain without objective findings; no alteration of motion segment integrity or herniated disk at the level and on the side that would be expected from objective clinical findings, but without radicular signs following conservative treatment or fractures: (1) less than 25% compression of one vertebral body; (2) posterior element fracture without dislocation that has healed without alteration of motion segment integrity or radiculopathy; (3) a spinous or transverse process fracture with displacement, but without a vertebral body fracture.</td>
</tr>
<tr>
<td>III 15%-18% Impairment of the Whole Person</td>
<td>Ongoing neurologic impairment of the lower extremity related to a thoracolumbar injury, documented by examination of motor and sensory functions, reflexes, or findings of unilateral atrophy above or below the knee related to no other condition; impairment may be verified by electrodiagnostic testing or clinically significant radiculopathy, verified by an imaging study that demonstrates a herniated disk at the level and on the side that would be expected from objective clinical findings; history of radiculopathy, which has improved following surgical treatment or fractures: (1) 25% to 50% compression fracture of one vertebral body; (2) posterior element fracture with mild displacement disrupting the canal; in both cases the fracture has healed without alteration of structural integrity; differentiation from a congenital or developmental condition should be accomplished, if possible, by examining preinjury roentgenograms, if available, or by a bone scan performed after the onset of the condition.</td>
</tr>
<tr>
<td>IV 20%-23% Impairment of the Whole Person</td>
<td>Alteration of motion segment integrity or bilateral or multilevel radiculopathy; alteration of motion segment integrity is defined from flexion and extension radiographs as translation of one vertebra on another of more than 2.5mm; radiculopathy as defined in thoracic category III need not be present if there is alteration of motion segment integrity; if an individual is to be placed in DRE thoracic category IV due to radiculopathy, the latter must be bilateral or involve more than one level or fractures: (1) more than 50% compression of one vertebral body without residual neural compromise.</td>
</tr>
<tr>
<td>V 25%-28% Impairment of the Whole Person</td>
<td>Impairment of the lower extremity as defined in thoracolumbar category III and loss of structural integrity as defined in thoracic category IV or fractures: (1) greater than 50% compression of one vertebral body with neural motor compromise but not bilateral involvement that would qualify the individual for corticospinal tract evaluation.</td>
</tr>
</tbody>
</table>
EXAMPLE: THORACIC SPINE DRE

• **Subject:** 35 year old male
• **History:** Individual fell from the second floor of a building on which he was working and sustained a compression fracture of T8. He had minor right lower extremity weakness and numbness. After anterior surgical decompression and instrumented fusion from T7 through T9 he improved and was able to return to most ADL’s and walk without braces or crutches, but he still had weakness and patchy numbness in the right lower extremity.
• **Current Symptoms:** Minor pain on heavy activity.
• **Physical Exam:** Neurologically spotty numbness in the right lower extremity with 4/5 weakness and mild atrophy of the right thigh and leg muscles. Right lower extremity reflexes are slightly hyperactive.
• **Clinical Studies:** MRI: compression fracture T8 without canal compromise. Radiograph: treated fracture with fusion.
• **Diagnosis:** Compression fracture T8 treated surgically with mild residual right lower extremity neurologic involvement.
• **Impairment Rating:** 25% WP
EXAMPLE: THORACIC SPINE DRE

Comment: This individual qualifies for DRE thoracic category V because he has mild right lower extremity neurologic deficits (category III) and alteration of motion segment integrity given fusion (category IV). A combination of categories III and IV in the thoracic region means that the individual qualifies for category V.

NOTE: Because he has alteration of motion segment integrity of more than one level (multilevel fusion), he could also be rated by the ROM method.

The best approach would be to rate the individual by both methods and award the higher rating.
EXAMPLE: LUMBAR SPINE DRE

Subject: 25 year old man

History: Onset of back and left leg pain after a fall on a concrete surface while carrying a box. Initially presented with muscle spasm, an SLR on the left side at 60 degrees, a positive crossed SLR at 70 degrees, and an absent left Achilles tendon reflex. Treated with physical therapy but did not improve. Underwent surgical discectomy and arthrodesis of L5-S1 three months after the injury. After 9 months of rehabilitation, leg and back symptoms were diminished but present.

Current Symptoms: Back and thigh pain at rest and persistent numbness along the lateral side of the foot 1 year after the onset of symptoms. Pain and numbness prevent individual from maintaining a constant position, prolonged standing or walking, or performing his prior work, recreational, and some household activities.

Physical Exam: Severely restricted range of motion. Loss of the Achilles reflex. Numbness in the S1 nerve root distribution and dermatomal pain in the leg on SLR.
Clinical Studies: Original MRI: a severely degenerated L5-S1 disc with a herniation on the left side. Post-operative MRI with gadolinium: fibrosis, but no residual or recurrent herniation. Fusion appears solid.

Diagnosis: Left posterolateral disc herniation L5-S1 with S1 radiculopathy and severe disc degeneration, unresolved status post-discectomy and L5-S1 fusion.

Impairment Rating: 28% WP

Comment: Symptoms, physical findings, and imaging studies are all consistent with a symptomatic herniated disc. Excision of the offending disc and a single level fusion did not relieve all symptoms, which are supported by signs of a persistent radiculopathy. Individual qualifies for lumbar DRE category V because he has persistent radiculopathy as well as single level alteration of motion segment integrity.
QUESTIONS:

1. Spinal impairment impacts on:
   a. HPI
   b. ROM
   c. ROS
   d. ADL

2. What method of evaluation is advised by the “Guides”
   a. ROM method
   b. Injury method
   c. Disability method
   d. Handicap method

3. When should you do an impairment rating?
   a. On a personal injury patient
   b. On a workers’ compensation patient
   c. When asked by a patient
   d. When questioned by an insurance company
4. The final calculated whole person percentage should be rounded off to what?
   a. Nearest whole number
   b. Nearest 5%
   c. Nearest 10%
   d. Not at all

5. When ever dealing with range of motion of the same joint, the figures are what?
   a. Combined
   b. Added
   c. Divided
   d. Multiplied

6. In combining the following numbers, what order should they be placed?
   21, 6, 11, 14, 3, 12
   a. 21, 14, 12, 11, 6, 3
   b. 3, 6, 12, 11, 21, 14
   c. 3, 6, 11, 14, 12, 21
   d. 3, 6, 11, 12, 14, 21
7. Define impairment.
   a. Used in both legal and policy context to describe individuals living with physical problems.
   b. An alteration of an individual’s capacity to meet personal, social, or occupational demands.
   c. A loss, loss of use, or derangement of any body part, organ system or function.
   d. None of the above.

8. What are the two approaches to assigning a patient to a DRE category?
   a. Impairment, disability
   b. Symptoms, diagnosis
   c. Signs, fractures
   d. None of the above

9. A compression fracture rating is based on what?
   a. Location
   b. Percentage
   c. Position
   d. Opinion
10. Multiple fractures of the posterior elements of a vertebra are rated:
   a. As a single fracture
   b. Separately
   c. Depends on which element is fractured
   d. Depends on whether the spinous process is fractured

11. What instrument is used to measure spinal range of motion.
   a. Goniometer
   b. Protractor
   c. Compass
   d. Inclinometer

12. What are the landmarks for measuring cervical range of motion?
   a. T1 and Atlas
   b. C7 and Occiput
   c. Occiput and T1
   d. Atlas and Occiput

13. In measuring the Thoracic spine in flexion/extension, the first step is what?
   a. Zero the inclinometer against C7
   b. Zero the inclinometer against T1
   c. Zero the inclinometer against the occiput
   d. Zero the inclinometer against the wall
14. In measuring the Thoracic spine for flexion/extension the subject is placed in what position?
   a. Flexed
   b. Extended
   c. Military
   d. Natural

15. In the L/S region, hip flexion accounts for what percentage of total flexion?
   a. 25%
   b. 50%
   c. 75%
   d. Not involved

16. In the DRE method of evaluation, the most commonly used categories are what?
   a. I, IV, V
   b. II, III, IV
   c. I, II, III
   d. They are all used about the same
17. What category would a HNP without radiculopathy be placed?
   a. I  
   b. II 
   c. III 
   d. IV 

18. What category would a 25% compression fracture or posterior element fracture be placed?
   a. I  
   b. II 
   c. III 
   d. IV 

19. According to the 5th edition of the Guides, which is true?
   a. Use the version that was used at the time of the injury 
   b. Use the first edition whenever possible 
   c. Use the most current edition 
   d. Use any edition
20. What orthopedic test is used for comparing the validity of hip flexion?
   a. Laségue
   b. Fabere Patrick
   c. SLR
   d. Braggard
Lines are drawn along the superior border of the vertebral body of the lower vertebrae and the superior border of the body of the upper vertebrae and the lines extended until they join. The angles are measured and subtracted. Note that lordosis (extension) is represented by a negative angle and kyphosis (flexion) by a positive angle. Loss of motion segment integrity is defined as motion greater than 15° at L1-2, L2-3, and L3-4 and greater than 20° at L4 to L5. Loss of integrity of the lumbosacral joint is defined as angular motion between L5 and S1 that is greater than 25°. The flexion angle is +8° and the extension angle is −18°. In the illustration, the flexion angle is −8°. Therefore (+8) − (−8) = +26° and would qualify for loss of structural integrity at any lumbar level.
The purpose of our discussion, regarding AOMSI, is not to make you into a radiologist. In fact, it is my opinion that a referral to a chiropractic radiologist would make the most sense when using this method.

Remember, you have to defend your opinion!
AOMSI

• The term AOMSI (Alteration Of Motion Segment Integrity) was first used in the Fourth Edition of the Guides to describe the loss of motion segment integrity, identified on FLEXION/EXTENSION x-rays.

• There are several technical considerations in obtaining and interpreting radiographic studies to evaluate AOMSI, including:
  • Magnification
  • Film quality
  • Normal thresholds for translation and angular motion
• “AOMSI as described in the *Guides* is assessed by plain film flexion-extension radiographs ONLY.”

• “Source to image distance (SID) for flexion-extension x-rays of the thoracic and lumbar spine is not defined in the literature or medical practice; however, 40” SID imaging parameters are most commonly used in the lumbar spine.”

• If a diagnosis of AOMSI, pseudoarthrosis, fracture, or spondylolisthesis is made, imaging studies should be excluded as a grade modifier.
With an understanding that we are not radiologists, the following are some of the figures described in the 6th Edition of the *Guides*:

- **Cervical Spine:**
  - A diagnosis of AOMSI in the cervical spine by translation measurements requires greater than 20% anterior or posterior relative translation of one vertebra on another or angular motion of more than 11 degrees greater than each adjacent level on the flexion x-ray.

- **Thoracic Spine:**
  - A diagnosis of AOMSI in the thoracic spine by translation measurements requires at least 2.5 mm anterior or posterior translation of one vertebra on another.
• Lumbar Spine:
  
  • A diagnosis of AOMSI in the lumbar spine by translation measurements requires greater than 8% anterior or 9% posterior relative translation of one vertebra on another.

• Lumbosacral Spine:
  
  • A diagnosis of AOMSI in the lumbosacral spine by translation measurements requires greater than 6% anterior or greater than 9% posterior relative translation at L5-S1 of L5 on S1.

NOTE: “The identification of degenerative disk disease at one or multiple levels, similar to the finding of arthrosis in an extremity joint, is not diagnostic of an injury, or disease, related pathology because such degenerative changes can be a natural consequence of the aging process.”
Questions
1. What does AOMSI mean?
   Alteration of Motion Segment Integrity

2. When using the AOMSI what specific views are used?
   Anterior and Posterior

3. What are the technical considerations used when obtaining or interpreting x-rays for an AOMSI?
   - Magnification
   - Film quality
   - Normal thresholds for translation and angular motion.

4. What is the SID for a lumbar x-ray when evaluating for an AOMSI?
   40”