Evidence-Based Medicine and the Forensic Examination
Montana State Fund 17th Annual Course
Helena, Montana, June, 2017

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Certified Examiner in Impairment and Disability Ratings

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Terminology

= Spondylosis
Disc bulge

- Diffuse
- Central
- Asymmetric
- Far Lateral
Disc Protrusion
Disc Extrusion
Disc Sequestration
Annular Tear

L4/5 Annular Tear
L5/S1 disc bulge
Degenerate disc

© A/Prof Peter J Papantoniou
Lumbar Stenosis
Spondylolostesis

Pars Interarticularis

Spondylolysis

Spondylolisthesis
Spondylolisthesis
EBM Levels of Evidence Pyramid

- **Meta-analysis**
- **Systematic Reviews**
  - RCTs and controlled clinical trials help to answer treatment questions and diagnosis questions. If there aren’t any RCTs or controlled clinical trials, move down the pyramid to the next best option.
- **Randomized Controlled Trials**
- **Cohort Studies**
  - Cohort Studies help to answer prognosis questions and etiology/harm questions.
- **Case Control Studies**
  - When you cannot find a cohort study to answer your prognosis or etiology/harm question, look for a Case Control Study.
- **Case Series & Case Reports**
  - When you cannot find a cohort study or a case control study to answer your prognosis or etiology/harm question, look for a Case Series or Case Report.
- **Animal Studies / Laboratory Studies**
The 5 Steps of Evidence-Based Medicine

Step 1: Ask a clinical question
Step 2: Acquire the best evidence
Step 3: Appraise the evidence
Step 4: Apply the evidence
Step 5: Assess your performance
Prevalence of Spondylosis by Age in asymptomatic people:

<table>
<thead>
<tr>
<th>Age</th>
<th>Bulge</th>
<th>Protrusion</th>
<th>S-lithstesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>30%</td>
<td>29%</td>
<td>3%</td>
</tr>
<tr>
<td>80</td>
<td>84%</td>
<td>43%</td>
<td>50%</td>
</tr>
</tbody>
</table>

- Disc degeneration in 96% at age 80!

Brinjijki and Leutmer, AMJR, 2015
## Prevalence in Asymptomatic People: Lumbar Disc Degeneration

<table>
<thead>
<tr>
<th>Age</th>
<th>Degen</th>
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</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>37%</td>
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</tr>
<tr>
<td>30-39</td>
<td>50%</td>
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</tr>
<tr>
<td>40-49</td>
<td>70%</td>
<td>50%</td>
<td>35%</td>
</tr>
<tr>
<td>50-59</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>90%</td>
<td>70%</td>
<td>40%</td>
</tr>
</tbody>
</table>

**Annular Tear:**
- 20% at age 20
- 30% at age 80

Jarvik, 2015 AJNR
### Prevalence in Asymptomatic People: Lumbar Disc Degeneration

<table>
<thead>
<tr>
<th>Age</th>
<th>Degen</th>
<th>Bulge</th>
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<td>70%</td>
<td>40%</td>
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</tr>
</tbody>
</table>

“So, Dr. Kraemer, you’re telling me that my 25yo...”

Are there different disease processes???

Jarvik, 2015 AJNR
Modic Changes

MC type I (arrows): hypointense on T1WI (A) and hyperintense on T2WI (B)

MC type II (arrows): hyperintense on T1WI (A) and isointense or hyperintense on T2WI (B)

MC type III (arrows): hypointense on T1WI (A) and hypointense on T2WI (B)
Spondylosis is degenerative!
Disc Degeneration ≠ Back Pain!

<table>
<thead>
<tr>
<th>Age</th>
<th>Disc Bulge</th>
<th>Disc Protrusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>50%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Degeneration increases with Age,

>>> Back Pain!

People who exercise have LESS back pain:
Disc Herniation ≠ Sciatica!

1 year study:
   Early Surgery vs Prolonged Medical Therapy

At 1 Year:
   84% favorable outcome (all patients)
   Disc Herniation: 85% with Favorable Outcome
   No Disc Herniation: 83% with Favorable Outcome

Same for Disc Herniation with Nerve Root Compression
Same for Post-op with or without Enhancement on Nerve

el Barzouhi, NEJM, 2013
Twin Studies
Twin Spine Study

Monozygotic Twins:
Journalist/farmer or Programmer/plumber
MRIs looked remarkably similar!!!

- Genetics: Strong
- Work Load: No association
- Leisure activities: No association
- Driving/Body Vibration: No association
- Smoking: + Small

Battié, et al, Spine 2010
Twin Spine Study:
Monozygotic Twins with different occupations:
Degeneration is Genetic!

Minor Trauma

5 year study of 200 people with Neck Pain:
• 16 episodes of Major Trauma:
• 170/200 had 652 episodes of Minor Trauma: Falls, Lifting, MVA, Sports Injuries
• 1/200 Disc Herniation: NOT assoc. with trauma!

93% predictive ability for Disabling Low Back Pain:
• abnormal baseline psych profile or
• previous disputed compensation claim
• NOT improved by adding falls, lifting or MVA

Carragee, Spine 2006
What does the Science Say? Low Back Pain (LBP):

- Insufficient Evidence for **Heavy Work**
- Insufficient Evidence for **Awkward Positions**
- Insufficient Evidence for **Flexion (Bending)**
- Insufficient Evidence for **Twisting**
What does the Science Say? Low Back Pain (LBP):

• Strong Evidence: Sitting is **NOT** associated LBP
• Strong Evidence that Standing/Walking < 2 hrs/day is **NOT** associated with LBP.
• Insufficient Evidence for Standing/Walking > 2h/d
What does the Science Say?

Low Back Pain (LBP):

- Strong Evidence that Previous LBP is a risk factor for future LBP
- Strong Evidence that AGE is NOT a factor in LBP.
- Insufficient Evidence for Smoking in LBP
- Insufficient Evidence for Obesity in LBP
- Strong Evidence that Exercise and Leisure Activities are NOT associated with LBP
Summary of EBM: (Battié, Carragee, Jarvik, et al)

For the LUMBAR SPINE:

- Degenerative Changes are Common.
- Degenerative Changes = age and genetics.
- Degenerative Changes do NOT imply symptoms.
- Minor Trauma rarely causes structural changes.
- Disability is predicted by psychological status, smoking, and compensation issues.
EBM in Cervical Disease:

Can we extrapolate the Lumbar Spine literature to the Cervical Spine?

And what are the limitations of doing so?
Cervical Spondylosis; Pathology

- Age Related Degeneration and Dehydration of intervertebral Disks
- Decreased cartilage between adjacent vertebral bodies
- Developmental laxity in the spinal supportive ligaments
- Hyper-mobility of spinal segment
- Bone-on bone apposition propagates bone spur formation which narrow the cervical spinal canal and may compress the cervical nerve roots and spinal cord.
Cervical Stenosis
## Prevalence in Asymptomatic People: Cervical Disc Degeneration

Matsumoto, J Bone & Joint Surgery, 1998

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<tr>
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<tbody>
<tr>
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<td>65%</td>
<td>25%</td>
</tr>
<tr>
<td>60</td>
<td>85%</td>
<td>30%</td>
</tr>
</tbody>
</table>

7% with spinal cord compression on MRI

Matsumoto, J Bone & Joint Surgery, 1998
# Tandem Changes in the Lumbar and Cervical Spine

Matsumoto, 2012

<table>
<thead>
<tr>
<th>Findings</th>
<th>Lumbar spine</th>
<th>Cervical spine</th>
<th>Tandem positive findings&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease in signal intensity</td>
<td>70 (74.5 %)</td>
<td>76 (80.9 %)</td>
<td>61 (64.9 %)</td>
</tr>
<tr>
<td>Posterior disc protrusion</td>
<td>74 (78.7)</td>
<td>72 (76.6)</td>
<td>62 (66.0)</td>
</tr>
<tr>
<td>Anterior compression of dura</td>
<td>77 (81.9)</td>
<td>76 (80.9)</td>
<td>64 (68.1)</td>
</tr>
<tr>
<td>Disc space narrowing</td>
<td>20 (21.3)</td>
<td>32 (34.0)</td>
<td>10 (10.6)</td>
</tr>
<tr>
<td>Spinal canal stenosis</td>
<td>12 (12.8)</td>
<td>13 (13.8)</td>
<td>4 (4.3)</td>
</tr>
<tr>
<td>Any one of the five findings</td>
<td>79 (84.0)</td>
<td>85 (90.4)</td>
<td>74 (78.7)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Any one of the five findings
What does the Science Say?
Neck Pain

Insufficient Evidence for
- Heavy Work
- Neck Posture
- Prolonged Work in a sedentary position
- Repetitive and Precision Work
What does the Science Say? Neck Pain

+ Evidence:
  - AGE
  - Female Gender
  - Previous history of Neck/shoulder pain

Note: Past records are REALLY helpful!
Whiplash-Associated Disability (WAD)

- Only 50% symptom free at 1 year.
- Age: Younger ages have increased pain.
- Worse pain at onset affects duration of symptoms.
- + Neurologic findings at onset affects duration.
- Frequent, early health care usage predicts poorer outcome.

Psychological Findings: Worse outcomes with:
- Post-injury psychological distress
- Passive coping style

WAD I&II, 2008
Whiplash-Associated Disability (WAD)

No evidence

- Severity of crash affects rate of WAD
- Preexisting degenerative changes affect rate.
- Awareness of impending crash and neck position affect rate.

Fewer claims are made when pain/suffering compensation is eliminated.

Carroll and Holm, WAD I&II, 2008
Evidence Based Medicine:

Objective Findings and the Neurologic Examination:
Cervical Radiculopathy
Cervical Myelopathy

Symptoms
Lumbar radiculopathy
Cauda Equina Syndrome
Note: Schematic demarcation of dermatomes (according to Kregel and Garrett) shown as shaded segments. There is actually considerable overlap between adjacent dermatomes. An alternative dermatome map is provided online.
DERMATOMES
Myotomes
Motor strength

<table>
<thead>
<tr>
<th>Grade 5</th>
<th>Normal power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 4</td>
<td>Active movement against gravity with resistance</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Active movement against gravity without resistance</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Active movement with gravity eliminated</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Only a trace or flicker of movement</td>
</tr>
<tr>
<td>Grade 0</td>
<td>No movement</td>
</tr>
</tbody>
</table>
Non-physiologic findings:

Motor Strength:
• Give-way weakness
• Ratcheting
• Cog-wheeling (not Parkinson’s)

Sensory:
• Non-dermatomal (entire extremity)
• Invalid two-point discrimination
• Midline split
• Entire hand
Waddell’s signs

Simulation
   Axial Loading
   Rotation

Distraction:
   Straight Leg Raising

Regional:
   Weakness
   Sensory

Overreaction:
   verbalization, facial expression, muscle tension and tremor, or collapsing
Waddell’s

• Study done on White Males:
• Significance requires judgement:
• Easy to place too much significance on findings:
• Is only one part of the Exam:
• Need to combine with objective medical findings.

Report reads:
• “Axial loading, shoulder loading, en-bloc rotation and light touch are (descriptor/positive/negative)”
• “Straight leg test with distraction is tolerated to ___degrees”
• “There is tenderness to deep palpation (multiple, described)”
• Or a description of exaggerated reaction, “grimace, sighs, nonphysiologic tremor, leg collapse with little weakness”…
Montana State Guidelines
Includes Definitions

Chronic Pain Guidelines:

**Pain Behaviors:** “Non-verbal communications

- grimacing, groaning,
- limping, using visible pain relieving or support devices
- requisition of pain medications,

Outward manifestations of pain, and through which a person may communicate that pain is being experienced”
The “thin-skull” rule:
Provides that a wrongdoer must take his victim as he finds him.

The aggressor is responsible for all of the consequences that ensue.
Previous condition:
latent, quiescent, Asymptomatic
AND
Non-disabling

Entire impairment is attributed to the injury, none to the pre-existing condition.
Preexisting condition is NOT Lit-up IF:

The condition was symptomatic before injury

Or

Condition was a naturally progressing condition that would have progressed to symptoms without the injury.
Lighting Up (WA)

Zavala v Twin City Foods: 2015

Knee injury vs. pre-existing arthritis:

The Court relied on:

expert witness medical testimony
to establish that the pre-existing condition was probably symptomatic,

over worker’s testimony that the condition was asymptomatic.
Prevention of Low Back Pain

Effective

• Exercise Interventions

Ineffective:

• Stress management
• Shoe inserts
• Back supports
• Ergonomic/back education
• Reduced lifting programs.
Now: What am I learning?

• 50% of fusions begin with a “strain”.
• EscSalating Disability Claims
• Can IME’s be Advocates for the Claimant?
• What are Best Practices for Examiners?
• What is Cost Effective?
• Specific Challenging syndromes
Chiari I and minor trauma
Incidental Findings on Brain MRI: Prevalence with 95% confidence intervals.
Overall Incidence 2.7% (1/37) --- Chiari I (1/400)

Zoe Morris et al. BMJ 2009;339:bmj.b3016
Symptomatic Chiari I after minor Trauma:

3/85 patients met criteria of:

• Initially Asymtomatic with no Neuro deficit.
• Symptoms of Concussion or Whiplash present immediately after the trauma.
• New Chiari-like symptoms in < 6 months.
• No other explanation.
• Surgery indicated with improvement or stabilized symptoms after surgery.

MJ Wan, Neurosurgery
Physical Findings of CTS

- **Phalen test**
  - Wrists maximally flexed, may produce symptoms within 60 seconds

- **Tourniquet test**
  - Blood pressure cuff on arm, inflated above systolic pressure, symptoms within 60 seconds

Slide Courtesy of Charles N. Brooks, MD
Diagnosing CTS

• History & physical exam often sufficient
• However, may get nerve conduction study (NCS) when:
  - Diagnosis is in doubt
  - Workers’ comp case
  - Surgery is considered
Carpal Tunnel Syndrome:

More likely to occur in:

- Women than men (4-5 X)
- 30-60 years of age
- Obese
- Physically inactive
Carpal Tunnel Syndrome:

**External forces:**
- Direct pressure,
- Repetitive high force wrist and finger motion
- Vibration

**Physiologic Factors:**
- Obesity
- Pregnancy
- Menopause
- Kidney failure
- Thyroid disease, esp. hypothyroidism
- Trauma

**Inflammation:** Gout, Infection, Rh arthritis, Tenosynovitis

**Neuropathic disorders:** Alcohol, Diabetes, Solvent exposure
Does Keyboarding Cause CTS?

- No
- Prevalence of CTS in computer users is similar to or lower than the general population
- Keyboarding may be protective

Slide Courtesy of Charles N. Brooks, MD
When is CTS Work Related?

- High force and repetition
- Vibration exposure
- Cold exposure ????

Slide Courtesy of Charles N. Brooks, MD
Vitamin D

VITAMIN D IN HUMAN DISEASE STATES

PARATHYROID
Hyperparathyroidism
Hyperparathyroidism
Pseudohypoparathyroidism
Secondary hypoparathyroidism

THYROID
Medullary carcinoma
Psoriasis

SKIN

LUNG
Sarcoidosis
Tuberculosis

KIDNEY
Chronic renal disease
Hypophosphatemic
VDDR
Vitamin D-dependent rickets

BLOOD
D3
25(OH)D3
1α,25(OH)2D3
24R,25(OH)2D3

PTH
CT
Ca2+
P1

DIET
D3
Ca2+, P1

INTESTINE

BONE
Anticonvulsant treatment
Fibrogenesis
Osteogenesis imperfecta ossium
Osteitis fibrosa cystica
Osteomalacia
Osteoporosis
Osteopenia
Osteosclerosis
Renal osteodystrophy Rickets

150 ng/ml
vitamin D intoxication

100 ng/ml
overdosed, but not yet toxic

70 ng/ml
upper norm

50 ng/ml
optimal vitamin D level

30 ng/ml
suboptimal vitamin D level

20 ng/ml
vitamin D deficiency

10 ng/ml
serious vitamin D deficiency

5 ng/ml
severe vitamin D deficiency

0 ng/ml
• Improves Fusion Rate
• Decreases Low Back Pain
• Improves Migraine, Depression
• Improves Bone Health
• Lowers Risk of:
  – Death, Diabetes, Cancer, MS, Asthma!
Low Vitamin D levels worsen Migraine
More Vitamin D decreases health problems

Fusion Rate

Data from Grassroots Health June 2013
Vitamin D

Below 30
- Deficient. Talk to your doctor about supplements.

30 to 50
- Generally inadequate for bone and overall health.

50 and above
- Adequate (but more is not necessarily better).

125 and above
- Too high (may have adverse effects).

Decay in serum 25(OH)D levels with increasing BMI

25 (OH)D decrease per each 5 kg/m² BMI increase
- Women: 4.5 nmol/L
- Men: 5.5 nmol/L
- All: 5 nmol/L

<table>
<thead>
<tr>
<th>Study</th>
<th>25(OH)D (±SD) (nmol/L)</th>
<th>Age (±SD) (years)</th>
<th>BMI range (kg/m²)</th>
<th>Gender</th>
<th>25(OH)D decrease* (nmol/L)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>McGill et al.</td>
<td>62.2 (22.7)</td>
<td>47.6 (± 11.6)</td>
<td>29–50</td>
<td>Women, men</td>
<td>0.7 nmol/L</td>
<td>0.002</td>
</tr>
<tr>
<td>Rodrigues-Rodrigues</td>
<td>56.6</td>
<td>27.8 (± 4.6)</td>
<td>24–35</td>
<td>Women</td>
<td>1.2 nmol/L</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Stein et al.</td>
<td>44.9 (22)</td>
<td>33 (12)</td>
<td>35–65</td>
<td>Women, men</td>
<td>1.3 nmol/L</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>
Which is cost-effective?
# Co-Morbidity with Migraine

<table>
<thead>
<tr>
<th>Condition</th>
<th>F (df-btw, df-tot)</th>
<th>P-value</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>192.034 (1, 2,909)</td>
<td>0.000</td>
<td>0.062</td>
</tr>
<tr>
<td>Anxiety</td>
<td>120.116 (1, 2,909)</td>
<td>0.000</td>
<td>0.040</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.015 (1, 2,909)</td>
<td>0.045</td>
<td>0.001</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>0.607 (1, 2,909)</td>
<td>0.436</td>
<td>0.000</td>
</tr>
<tr>
<td>Hypertension</td>
<td>38.634 (1, 2,909)</td>
<td>0.000</td>
<td>0.013</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7.148 (1, 2,909)</td>
<td>0.008</td>
<td>0.002</td>
</tr>
<tr>
<td>Bipolar</td>
<td>8.989 (1, 2,909)</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td>IBS</td>
<td>73.210 (1, 2,909)</td>
<td>0.000</td>
<td>0.025</td>
</tr>
<tr>
<td>Chronic pain</td>
<td>107.060 (1, 2,909)</td>
<td>0.000</td>
<td>0.036</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>39.812 (1, 2,909)</td>
<td>0.000</td>
<td>0.014</td>
</tr>
<tr>
<td>Thyroid disease</td>
<td>35.871 (1, 2,909)</td>
<td>0.000</td>
<td>0.012</td>
</tr>
<tr>
<td>Chronic fatigue</td>
<td>64.419 (1, 2,909)</td>
<td>0.000</td>
<td>0.022</td>
</tr>
<tr>
<td>Asthma</td>
<td>30.355 (1, 2,909)</td>
<td>0.000</td>
<td>0.010</td>
</tr>
<tr>
<td>COPD</td>
<td>6.326 (1, 2,909)</td>
<td>0.012</td>
<td>0.002</td>
</tr>
<tr>
<td>Autoimmune disorder</td>
<td>12.335 (1, 2,909)</td>
<td>0.000</td>
<td>0.004</td>
</tr>
<tr>
<td>Negative life event score H, M, L</td>
<td>107.144 (2, 2,909)</td>
<td>0.000</td>
<td>0.069</td>
</tr>
<tr>
<td>Migraine symptoms per month (n)</td>
<td>1028.578 (5, 2,909)</td>
<td>0.000</td>
<td>0.639</td>
</tr>
</tbody>
</table>
Depression

Genetics:

• Migraine,
• Depression,
• Motion Sickness,
• Alcohol
# Depression Worsens Outcome after Lumbar Fusion

<table>
<thead>
<tr>
<th></th>
<th>Depression Group (n = 123)</th>
<th>Control Group (n = 2676)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days absent from work AIF* (mean ± SD)</td>
<td>1077.4 ± 99.7</td>
<td>893.4 ± 333.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Medical costs paid by BWC AIF† (mean ± SD)</td>
<td>$93,405.0 ± $41,749.0</td>
<td>$71,251.5 ± $41,094.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Narcotic utilization AIF (mean ± SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days supplied</td>
<td>836.0 ± 690.7</td>
<td>567.2 ± 596.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Net mg of MEQs prescribed</td>
<td>61,587.8 ± 80,207.7</td>
<td>40,241.6 ± 72,055.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Average MEDs</td>
<td>66.7 ± 48.7</td>
<td>62.1 ± 58.1</td>
<td>0.388</td>
</tr>
<tr>
<td>New psychological developments within 3 yr AIF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>0 (0.0%)</td>
<td>430 (16.1%)</td>
<td>...</td>
</tr>
<tr>
<td>Anxiety</td>
<td>1 (0.8%)</td>
<td>32 (1.2%)</td>
<td>0.701</td>
</tr>
<tr>
<td>Adjustment reaction</td>
<td>0 (0.0%)</td>
<td>50 (1.9%)</td>
<td>0.126</td>
</tr>
<tr>
<td>PTSD</td>
<td>5 (4.1%)</td>
<td>14 (0.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bipolar</td>
<td>0 (0.0%)</td>
<td>8 (0.3%)</td>
<td>0.544</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>0 (0.0%)</td>
<td>1 (&lt;0.1%)</td>
<td>0.830</td>
</tr>
<tr>
<td>Psychotherapy AIF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects using psychotherapy AIF</td>
<td>102 (82.9%)</td>
<td>617 (23.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean number of sessions</td>
<td>34.3 ± 37.5</td>
<td>5.2 ± 14.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Did sessions span from BIF to AIF‡</td>
<td>78 (63.4%)</td>
<td>47 (1.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Postsurgical infection</td>
<td>0 (0.0%)</td>
<td>10 (0.4%)</td>
<td>0.497</td>
</tr>
<tr>
<td>Failed back syndrome AIF</td>
<td>10 (8.1%)</td>
<td>234 (8.7%)</td>
<td>0.813</td>
</tr>
<tr>
<td>Nonunion/pseudoarthrosis AIF</td>
<td>1 (0.8%)</td>
<td>33 (1.2%)</td>
<td>0.677</td>
</tr>
<tr>
<td>Newly awarded permanent disability§ AIF</td>
<td>50 (40.7%)</td>
<td>1092 (40.8%)</td>
<td>0.972</td>
</tr>
<tr>
<td>All-cause mortality AIF</td>
<td>3 (2.4%)</td>
<td>47 (1.8%)</td>
<td>0.576</td>
</tr>
<tr>
<td>Subjects with additional lumbar surgery AIF</td>
<td>23 (18.7%)</td>
<td>524 (19.6%)</td>
<td>0.809</td>
</tr>
<tr>
<td>Mean major lumbar surgical procedures AIF</td>
<td>0.21 ± 0.47</td>
<td>0.23 ± 0.50</td>
<td></td>
</tr>
<tr>
<td>Subjects with additional lumbar fusion</td>
<td>19 (15.4%)</td>
<td>400 (14.9%)</td>
<td>0.879</td>
</tr>
<tr>
<td>Subjects with additional decompression</td>
<td>13 (10.6%)</td>
<td>300 (11.2%)</td>
<td>0.825</td>
</tr>
</tbody>
</table>

* AIF: After index fusion, in the context of this study, within 3 years after index fusion.
†Net medical costs paid for by the Ohio BWC within 3 years after index fusion.
§Permanent disability that was not awarded before fusion but was awarded AIF.
¶AIF indicates after index fusion; BWC, Bureau of Workers’ Compensation; MEQs, morphine equivalent units; MEDs, morphine equivalent units per day; PTSD, posttraumatic stress disorder.

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**Clinical Depression Is a Strong Predictor of Poor Lumbar Fusion Outcomes Among Workers’ Compensation Subjects**


doi: [10.1097/BRS.0000000000000863](https://doi.org/10.1097/BRS.0000000000000863)
Depression worsens Patient Satisfaction Scores after fusion

<table>
<thead>
<tr>
<th>Question</th>
<th>Nondepressed</th>
<th>Depressed</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>160</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Nurses <em>always</em> treated you with courtesy and respect</td>
<td>146/160 (91.3%)</td>
<td>45/57 (78.9%)</td>
<td>0.014*</td>
</tr>
<tr>
<td>Nurses <em>always</em> listened carefully to you</td>
<td>120/160 (75.0%)</td>
<td>44/57 (77.2%)</td>
<td>0.741</td>
</tr>
<tr>
<td>Nurses <em>always</em> explained things in a way you could understand</td>
<td>122/159 (76.7%)</td>
<td>38/57 (66.7%)</td>
<td>0.137</td>
</tr>
<tr>
<td>Doctors <em>always</em> treated you with courtesy and respect</td>
<td>142/160 (88.8%)</td>
<td>41/56 (73.2%)</td>
<td>0.005*</td>
</tr>
<tr>
<td>Doctors <em>always</em> listened carefully to you</td>
<td>131/160 (81.9%)</td>
<td>38/56 (67.9%)</td>
<td>0.029*</td>
</tr>
<tr>
<td>Doctors <em>always</em> explained things in a way you could understand</td>
<td>124/160 (77.5%)</td>
<td>39/56 (69.6%)</td>
<td>0.240</td>
</tr>
<tr>
<td>Your room and bathroom were <em>always</em> kept clean</td>
<td>124/158 (78.5%)</td>
<td>43/57 (75.4%)</td>
<td>0.636</td>
</tr>
<tr>
<td>The area around your room was <em>always</em> quiet at night</td>
<td>79/156 (50.6%)</td>
<td>31/57 (54.4%)</td>
<td>0.628</td>
</tr>
<tr>
<td>You <em>always</em> got help in getting to the bathroom or using a bedpan as soon as you wanted it</td>
<td>77/114 (67.5%)</td>
<td>25/41 (61.0%)</td>
<td>0.447</td>
</tr>
<tr>
<td>After you pressed the call button, you <em>always</em> got help as soon as you wanted it</td>
<td>102/151 (67.5%)</td>
<td>26/53 (49.1%)</td>
<td>0.017*</td>
</tr>
<tr>
<td>Your pain was <em>always</em> well controlled</td>
<td>96/156 (61.5%)</td>
<td>28/57 (49.1%)</td>
<td>0.104</td>
</tr>
<tr>
<td>The hospital staff <em>always</em> did everything they could to help you with your pain</td>
<td>122/156 (78.2%)</td>
<td>37/56 (66.1%)</td>
<td>0.072</td>
</tr>
<tr>
<td>Before giving you any new medicine, hospital staff <em>always</em> told you what the medicine was for</td>
<td>95/124 (76.6%)</td>
<td>32/41 (78.0%)</td>
<td>0.850</td>
</tr>
<tr>
<td>Before giving you any new medicine, hospital staff <em>always</em> described possible side effects in a way you could understand</td>
<td>59/120 (49.2%)</td>
<td>16/40 (40.0%)</td>
<td>0.314</td>
</tr>
<tr>
<td>Hospital staff talked with you about whether you would have the help you needed when you left the hospital</td>
<td>141/145 (97.2%)</td>
<td>47/52 (90.4%)</td>
<td>0.042*</td>
</tr>
<tr>
<td>You got information in writing about what symptoms or health problems to look out for after you left the hospital</td>
<td>137/143 (95.8%)</td>
<td>47/53 (88.7%)</td>
<td>0.065</td>
</tr>
<tr>
<td>Staff took your preferences and those of your family into account in deciding what your health care needs would be</td>
<td>86/160 (53.8%)</td>
<td>28/57 (49.1%)</td>
<td>0.548</td>
</tr>
<tr>
<td>You had a good understanding of the things you were responsible for in managing your health</td>
<td>100/160 (62.5%)</td>
<td>33/57 (57.9%)</td>
<td>0.540</td>
</tr>
<tr>
<td>You clearly understood the purpose for taking each of your medications</td>
<td>110/160 (68.8%)</td>
<td>32/57 (56.1%)</td>
<td>0.086</td>
</tr>
<tr>
<td>Rated this hospital as a 9 or 10 out of 10 overall</td>
<td>131/160 (81.9%)</td>
<td>43/57 (75.4%)</td>
<td>0.295</td>
</tr>
<tr>
<td>Would definitely recommend this hospital to friends and family</td>
<td>134/160 (83.8%)</td>
<td>40/57 (70.2%)</td>
<td>0.027*</td>
</tr>
</tbody>
</table>

*All P values <0.05 were considered statistically significant.*
Treatment Implications:

- Migraine retards remission of Depression.
- Smoking Worsens pain, including Migraine.
- Depression worsens surgical outcomes.
- Depression worsens fusion outcomes.
- Exercise improves
  - depression,
  - migraine,
  - low back pain.
Treatment Implications:

How my practice is currently evolving:
- Medical Records Before and After Injury
- Objective Findings: (Physiologic and Non-Physiologic)
- Identify Concordant Findings:
- Screen for Chronic Pain, Depression & Migraine:

Treat with:
- Vitamin D to greater than 40ng/ml
- Magnesium and melatonin to improve sleep
- Encourage movement, exercise and RTW
References

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