Lumbar Fusion in Workers' Compensation

Evidence Based Medicine

1:30 to 2:30 pm

Thursday, May 31, 2018

James B. Talmage MD

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Developmental Defects

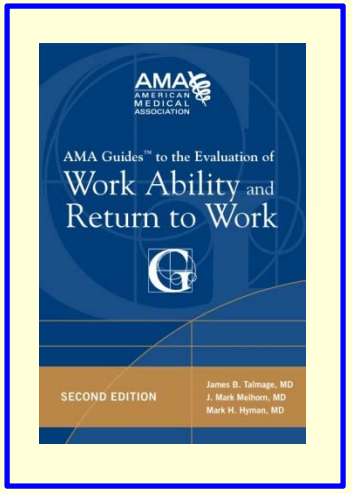
In 2016, I RETIRED

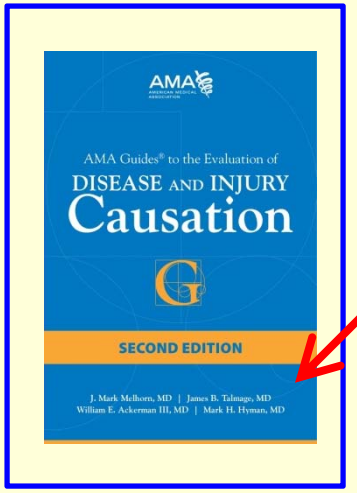
From Clinical Practice,

after 14,154 days as a treating physician

Paid For:

- Teaching:
  - SEAK
    - IME Course,
    - Evidence Based Medicine Course
  - ACOEM: Musculoskeletal Course
- Writing: AMA





Financial Conflict of Interest Disclosure

- **Paid** by the **State of Tennessee**
  - **Assistant Medical Director, Tennessee Bureau of Workers' Compensation**
- **Paid** by **US Government**
  - **Department of Transportation, Federal Motor Carrier Safety Division,**
    - **Consultant and Chair,**
      - **National Registry of Certified Medical Examiners Test Development Committee**

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

Financial Conflict of Interest

- **PAID** member physician advisory panel to the Ohio Police & Fire Pension Fund

James B. Talmage MD

Adjunct Associate Professor | **UNPAID**

Division of Occupational Medicine

– Department of Family and Community Medicine

Meharry Medical College, Nashville, TN

UNPAID FACULTY

- AAOS Workers' Comp Course 2001-2017

  20th Annual - Oct 26-28, 2018

  at AAOS Learning Center, Rosemont, IL

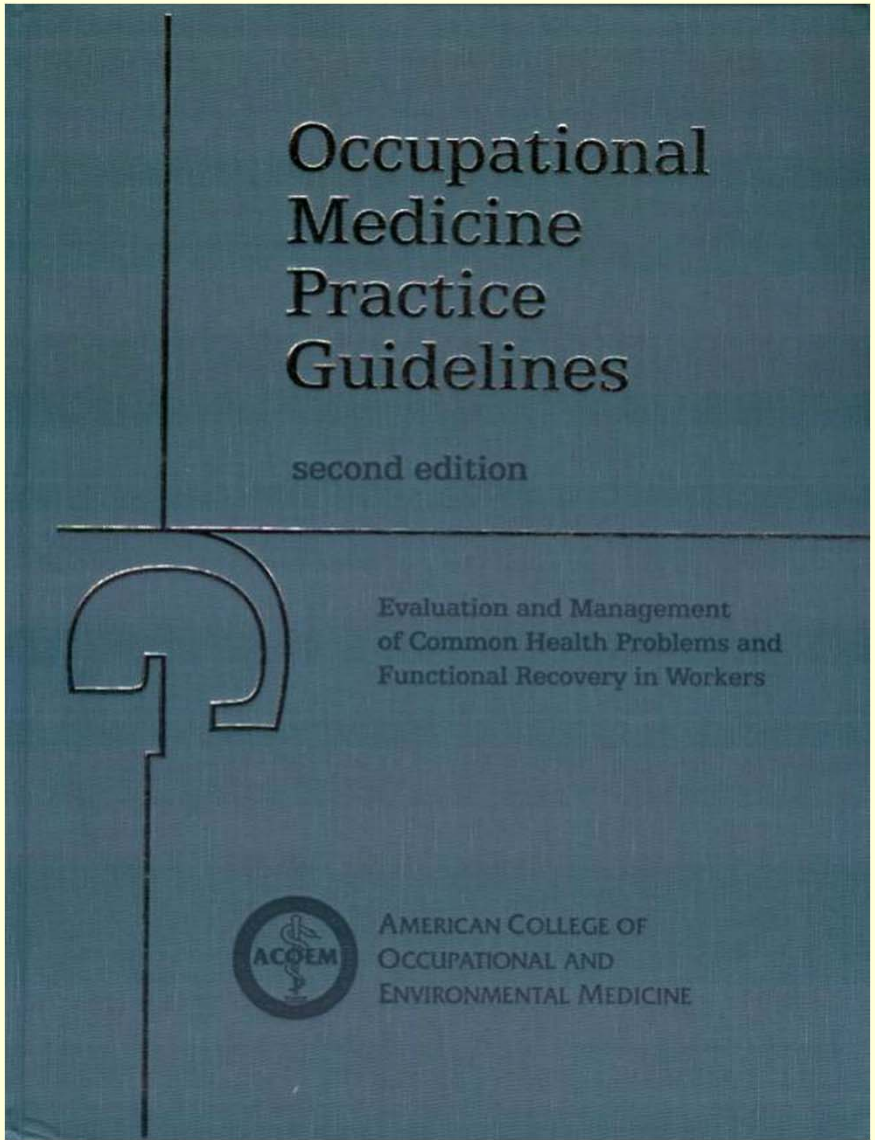
- ~~AADEP~~ [Now IAIME]
  - Past President
  - Annual meeting **01/16 to 01/19/19** in Tucson, AZ

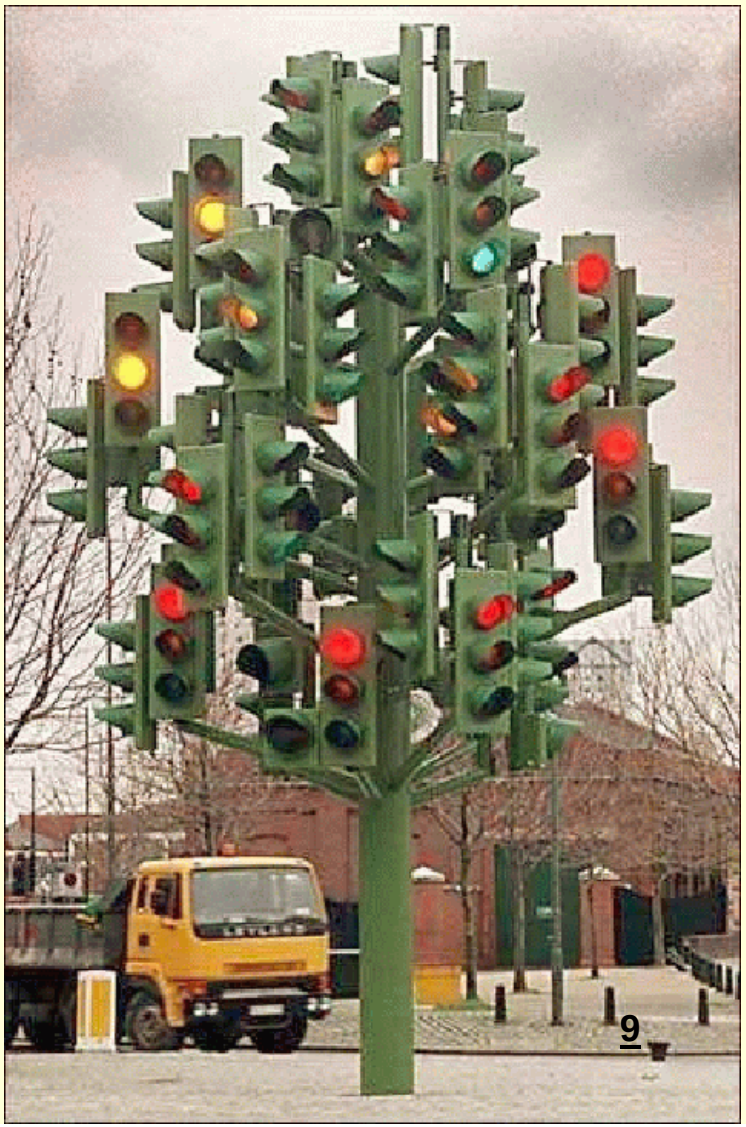
UNPAID Peer Reviewer

- *The Spine Journal*
- *Archives of Physical Medicine and Rehabilitation*
- *Journal of Bone & Joint Surgery*

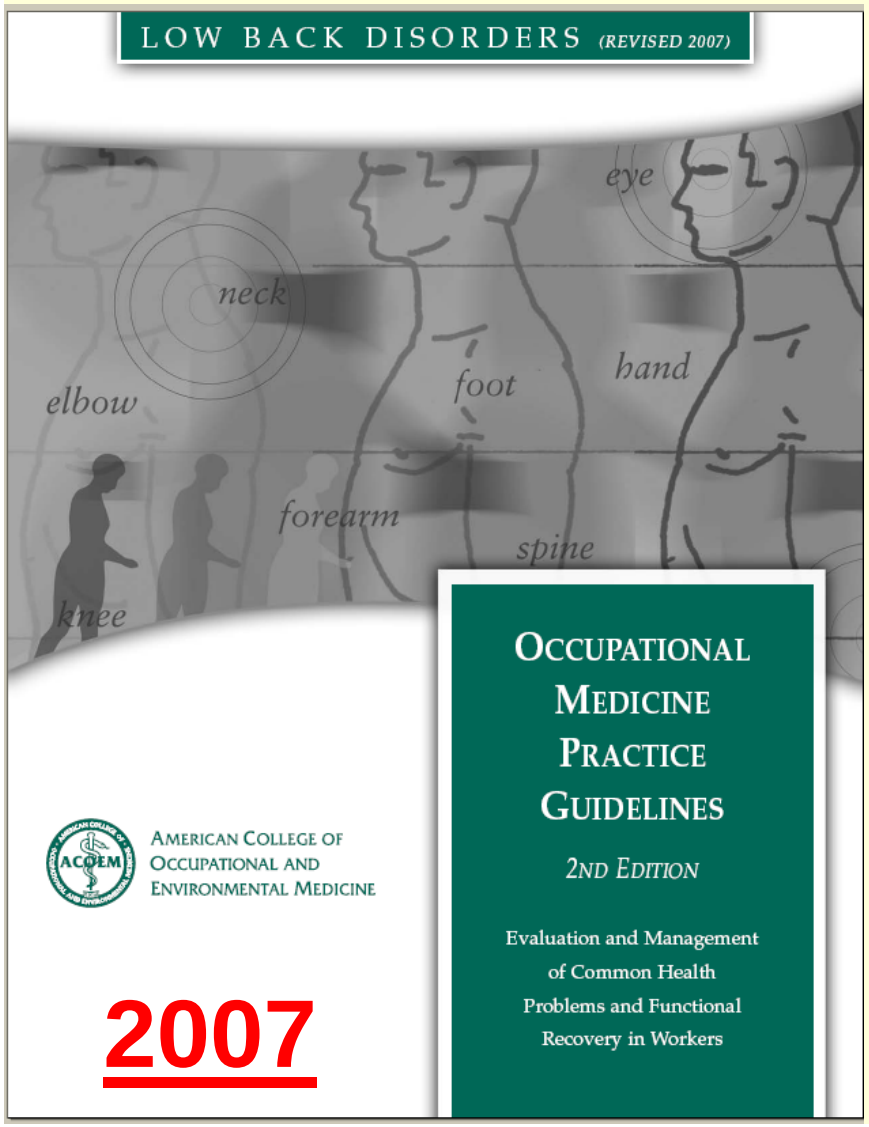
ACOEM's *Practice Guidelines, 2nd Edition*

NO Role





UNPAID CHAIR: Spine Committee



- **Low Back Chapter** 2007
  - 366 pages
  - **1310 articles** reviewed and referenced.
- Neck chapter 2011 update
  - 332 pages
  - **895 articles** reviewed and referenced

Back Pain Timing: ACOEM

- Acute: First 6 weeks
- Subacute: Weeks 1-12
- **Chronic > 12 weeks (3 months)**
- Note: Usual "soft tissue" healing time is 6-8 weeks.

ACOEM Guidelines **Categories**

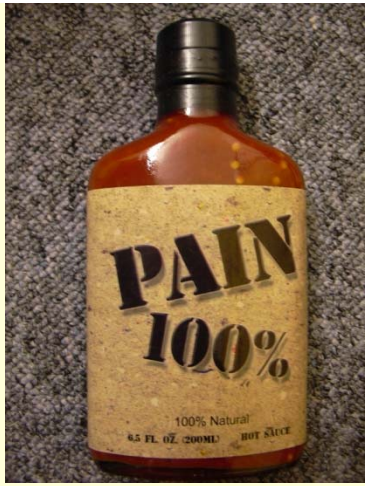
- Specific **Systemic Diseases**:
  - 1 - 2% of Patients presenting for primary care
  - Diagnosis by "Red Flags"
- **Cauda Equina Syndrome**: Very RARE
  (acute multiple bilateral nerve roots)
- **Radiculopathy** (nerve root)
  - Disc Herniation
- **Spinal Stenosis** (single or multiple nerve roots)
- **Spondylolisthesis**: 4 - 6% of population
  - **Instability is rare**, **radiculopathy is uncommon**

ACOEM **Categories**

EVERYTHING ELSE

- Big Category: **NON-Specific Low Back Pain**
- Usually **> 90% of patients** seen in primary care or general occupational medicine clinics

ACOEM: Definition



Chronic Nonspecific Low Back Pain:

- LBP lasting **longer than 3 months** (12 weeks) is defined in this document as "chronic."
- Classification of the types of LBP patients studied (e.g., chronic vs. subacute) in interventional studies evaluated in this document use this definition regardless of whether other definitions were used at the onset of chronic LBP (e.g., some use a 6-month duration).
- Chronic LBP is labeled as **"nonspecific"** when it is deemed to be **not attributable to a recognized, known specific pathology.**[18]

ACOEM Definition

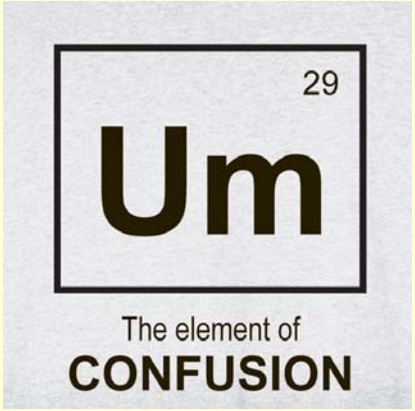
- The **vast majority of chronic LBP** is in the category of non-specific LBP.

- There is **no** scientific **consensus** that the pain-generating structure can be **reliably identified** in these pain syndromes.

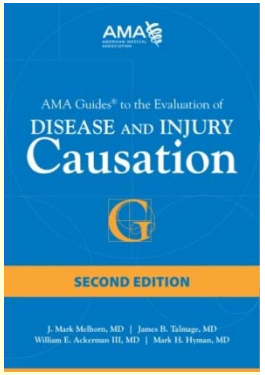
- **Included** in this category are terms used to attempt to describe these patients with specificity that includes "specific" terms such as **degenerative disc disease**, **discogenic back pain**, **black disc disease**, **micro instability**, **lumbar spondylosis**, **facet syndrome**, pyriformis syndrome, sacroiliac joint syndrome, and myofascial pain.

Articles are Published About Each of These …

- As IF the cause of low back pain could be clearly attributed to one of these structures or syndromes.
- BUT, the inclusion and exclusion criteria for the same condition **vary** widely
  - No agreement on how to diagnose these.

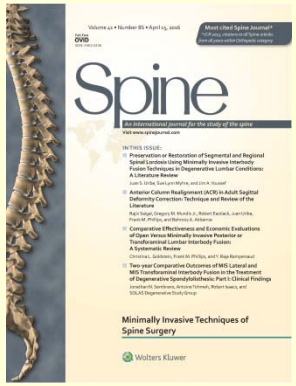


Non-Specific Back Pain



- Most authors today agree that despite modern medicine, *the pain generating structure for most adults with LBP cannot be reliably scientifically established.*
- There **are published articles on** facet pain, disc pain, SIJ pain, etc; however, *there is **no agreement** on how these syndromes can be reliably diagnosed,* and most of the low back literature uses the terms "nonspecific low back pain" or "low back pain."

Typical Current Article

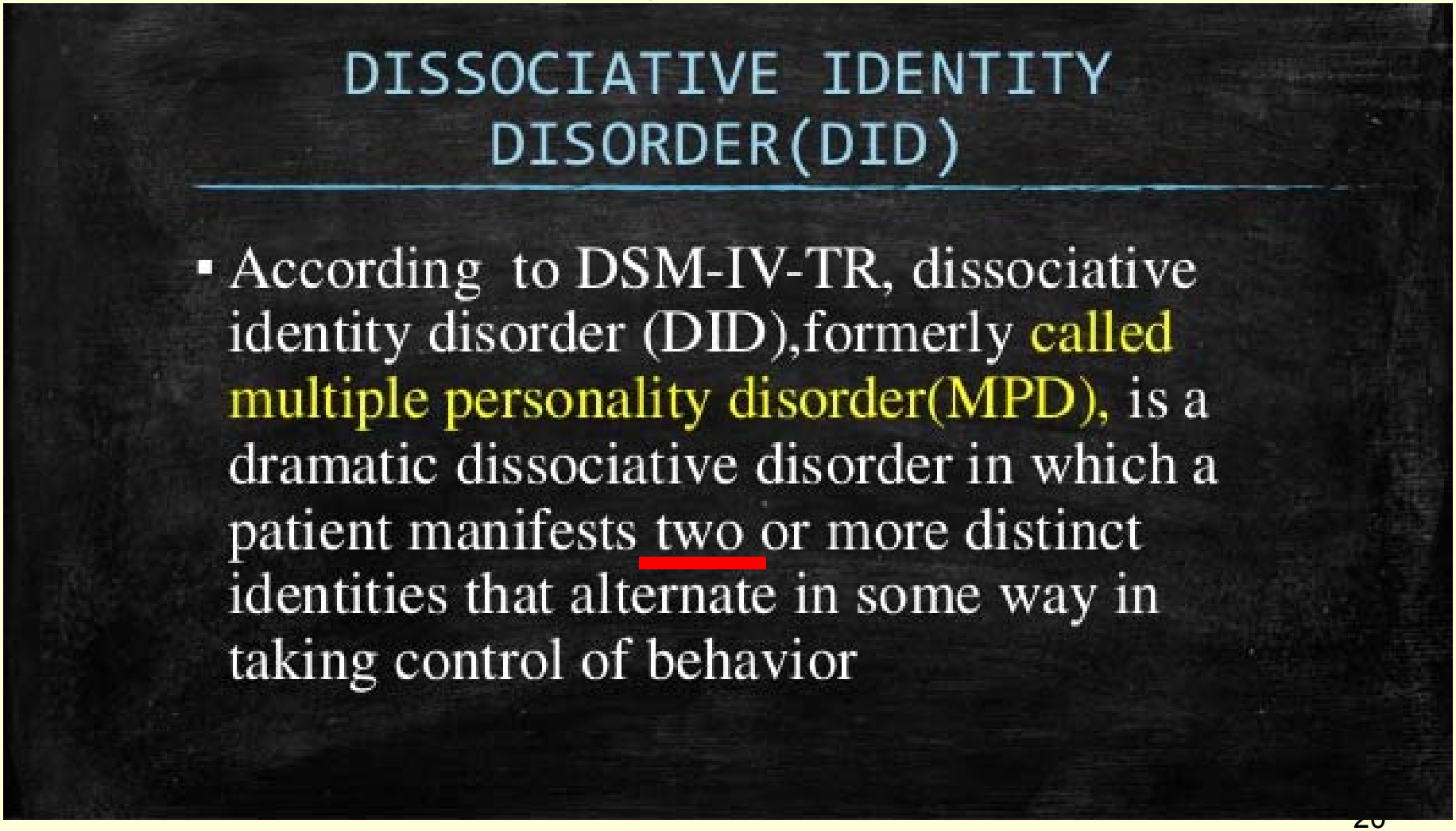


- H Kaneko, et al. Dysfunction of Nucleus Accumbens Is Associated With **Psychiatric Problems** in Patients With Chronic Low Back Pain: A Functional Magnetic Resonance Imaging Study. **SPINE 2017;** 42 (11): 844–853. [June 1st]
- First Paragraph:
- **Eighty-five percent of low back pain (LBP) is nonspecific in etiology,** that is, without any pathological findings or neurological encroachment.[1] Ninety percent of those patients healing naturally within 12 weeks,[2] the rest develop chronic LBP (cLBP) persistent over 12 weeks.[3] **Such development of cLBP is often complicated with psychiatric problems.** Patients with mild LBP with a high level of disability have been shown to be more depressed and have lower job satisfaction.[4] Furthermore, cLBP is closely associated with depression and anxiety and further exacerbates these psychiatric conditions.[5–8] It follows that a considerable portion of cLBP patients might have non-anatomical etiologies, which should not indicate surgical treatments.

Lancet LBP Series Working Group 2018 -

- http://dx.doi.org/10.1016/S0140-6736(18)30480-X
- 12 Authors, 9 countries, 12 pages, 119 References
- **For nearly all people with low back pain, it is not possible to identify a specific nociceptive cause.**
- Only a small proportion of people have a well understood pathological cause—eg, a vertebral fracture, malignancy, or infection.
- People with physically demanding jobs, physical and mental comorbidities, smokers, and obese individuals are at greatest risk of reporting low back pain.
- Disabling low back pain is over-represented among people with low socioeconomic status.

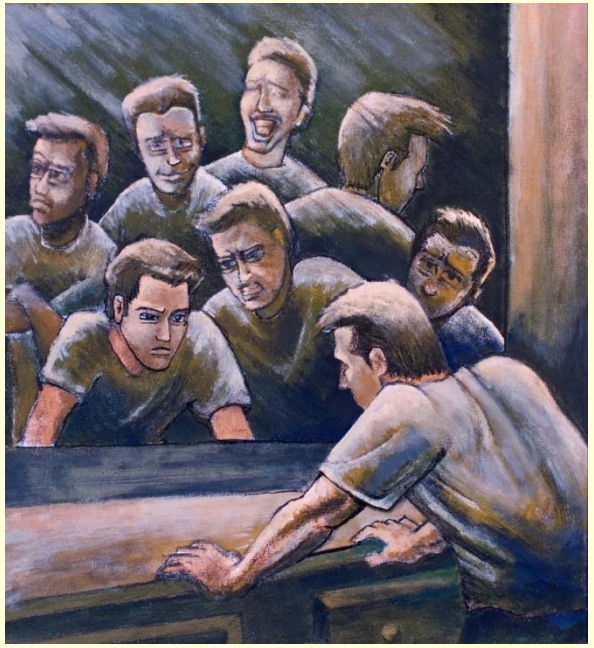
Literature Approach to LBP is Like Psychiatric DID



In the Same Issue Of the Same Journal

- Articles:
  - 90+% of back pain is **NON-specific.**
  - There is **no** scientifically validated way to determine the "pain generator".

- Article on "facet pain".
- Article on "discogenic pain".



Low Back Pain - Prevalence

- Hoy D, et al. A Systematic Review of Global Prevalence of Low Back Pain. Arthritis & Rheumatism **2012**; 64 (6): 2028-37.
- 165 Published studies from **54 countries**, with **966 estimates**
- Mean (±SEM):
  - **Point prevalence: 11.9%** ± 2%
  - **1 month prevalence: 23.2%** ± 2.9%

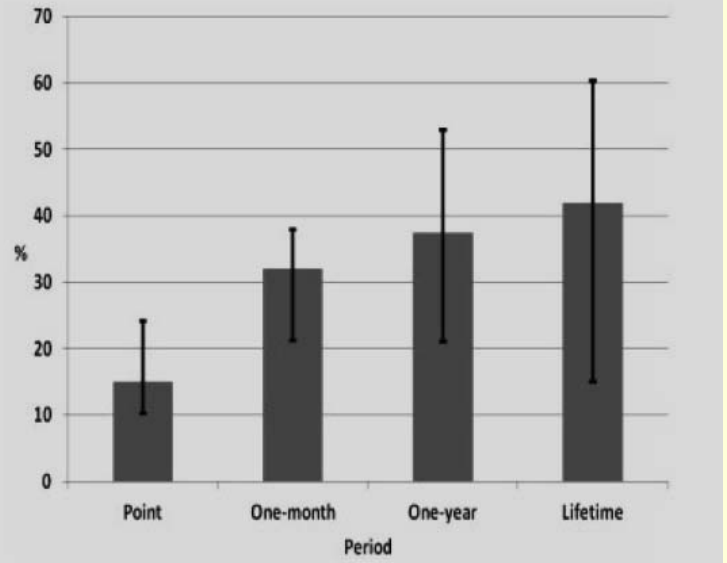


Figure 2. Median prevalence of low back pain, with interquartile range, according to prevalence period.

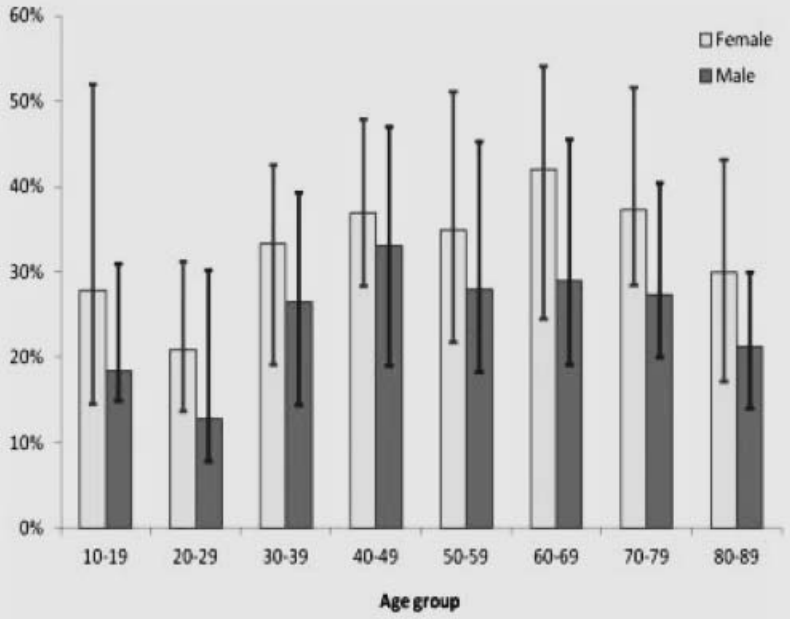


Figure 3. Median prevalence of low back pain, with interquartile range, according to sex and midpoint of age group. Midpoint = (lower limit of age group + [upper limit of age group – lower limit of age group]/2).

Back Pain: Prevalence in the USA

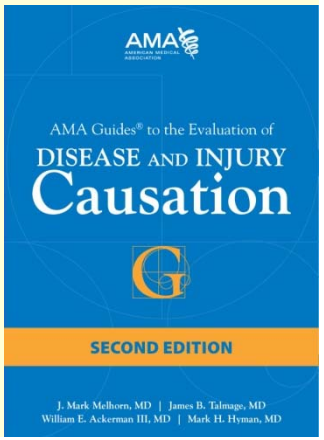
- Strine TW, Hootman JM. US National Prevalence and Correlates of Low Back and Neck Pain Among Adults. Arthritis and Rheumatism **2007**; 57 (4): 656-65.
- **US** adults in **2002** National Health Interview Survey (**n=29,828**)
- 3 month prevalence extrapolated to entire US adult population.
- **17%** (34 million adults) had low back pain only
- 4.4% (9 million adults) had neck pain only
- **9.3%** had BOTH low back **AND** neck pain
  - (19 million adults).
- Risk factors (statistically significant):
  - Smoking, correlated with back pain only and with both back and neck pain
  - Heavy alcohol use correlated with back pain only and neck pain only
  - Obesity correlated with back pain only.

Risk Factors for Low Back Pain

- Taylor JB, et al. Incidence and Risk Factors for first-time incident low back pain: a systematic review and meta-analysis. The Spine Journal **2014**; 14: 2299-2319.
- **41 Prospective, longitudinal studies** of adults, some "never" had had back pain, while some had a History of prior episode(s) but were pain free at baseline.
- First time incidence in community populations = 26%
  - (12-84 month follow up)
- First time incidence in working populations = 26%
  - (12-24 month follow up)
- Recurrence in community populations (pain free at baseline) = 27%
  - (follow up 12-36 months)
- Recurrence in working populations (pain free at baseline) = 27%
  - (follow up 6-72 months)
- **Risk factors:**
  - NONE identified in those without prior back pain episodes, thus NO guidance for Primary Prevention
  - Prior back pain episodes (# & severity) predicted recurrent episodes
  - Suggested emphasis should be on Secondary Prevention, not primary prevention

What We Really Care/Fight About

- While the preceding review has summarized the literature on risk factors for the common symptom of low back pain, causation issues are rare in cases with short duration back symptoms. The **disputes** arise over cases in which **new onset back pain** is allegedly related to a **risk factor**, and results in **persisting pain with disability**.
- Studies on this issue are uncommon.



Will This Patient Develop Persistent Disabling Low Back Pain?

JAMA 2010; 303: 1295-02

JAMA 2010; 303 (13): 1295-1302

Roger Chou, MD

Paul Shekelle, MD, PhD

PATIENT SCENARIO

A 48-year-old woman is evaluated in clinic with a 3-day history of low back pain without leg pain. She has no previous history of cancer and no weight loss, anorexia, or night sweats. Her physical examination reveals mild paralumbar tenderness with normal strength, sensation, and lower extremity reflexes. She has not worked for 3 days due to the back pain. She does not recall any specific work-related injury. She rates the pain as 8 out of 10 and reports little improvement with over-the-counter acetaminophen.

As her physician, you suspect acute nonspecific low back pain. You encourage her to remain active and prescribe nonsteroidal anti-inflammatory drugs. The patient states she is worried about her ability to return to work. She is avoiding many of her usual activities and has stopped doing her daily 2-mile walk due to the pain and fear of making her back worse. She also has a history of chronic depression. Will this patient develop chronic disabling low back pain?

Context Low back pain is extremely common. Early identification of patients more likely to develop persistent disabling symptoms could help guide decisions regarding follow-up and management.

Objective To systematically review the usefulness of individual risk factors or risk prediction instruments for identifying patients more likely to develop persistent disabling low back pain.

Data Sources Electronic searches of MEDLINE (1966-January 2010) and EMBASE (1974-February 2010) and review of the bibliographies of retrieved articles.

Study Selection Prospective studies of patients with fewer than 8 weeks of low back pain from which likelihood ratios (LRs) were calculated for prediction of persistent disabling low back pain for findings attainable during the clinical evaluation.

Data Extraction Two authors independently assessed studies and extracted data to estimate LRs.

Data Synthesis A total of 20 studies evaluating 10 842 patients were identified. Presence of nonorganic signs (median [range] LR, 3.0 [1.7-4.6]), high levels of maladaptive pain coping behaviors (median [range] LR, 2.5 [2.2-2.8]), high baseline functional impairment (median [range] LR, 2.1 [1.2-2.7]), presence of psychiatric comorbidities (median [range] LR, 2.2 [1.9-2.3]), and low general health status (median [range] LR, 1.8 [1.1-2.0]) were the most useful predictors of worse outcomes at 1 year. Low levels of fear avoidance (median [range] LR, 0.39 [0.38-0.40]) and low baseline functional impairment (median [range] LR, 0.40 [0.10-0.52]) were the most useful items for predicting recovery at 1 year. Results were similar for outcomes at 3 to 6 months. Variables related to the work environment, baseline pain, and presence of radiculopathy were less useful for predicting worse outcomes (median LRs approximately 1.5), and a history of prior low back pain episodes and demographic variables were not useful (median LRs approximately 1.0). Several risk prediction instruments were useful for predicting outcomes, but none were extensively validated, and some validation studies showed LRs similar to estimates for individual risk factors.

Conclusion The most helpful components for predicting persistent disabling low back pain were maladaptive pain coping behaviors, nonorganic signs, functional impairment, general health status, and presence of psychiatric comorbidities.

Likelihood Ratio

an attribute of a test

Changes

Pretest probability

to

Posttest probability

Ratio if positive

of > 10 means a test

is VERY useful.

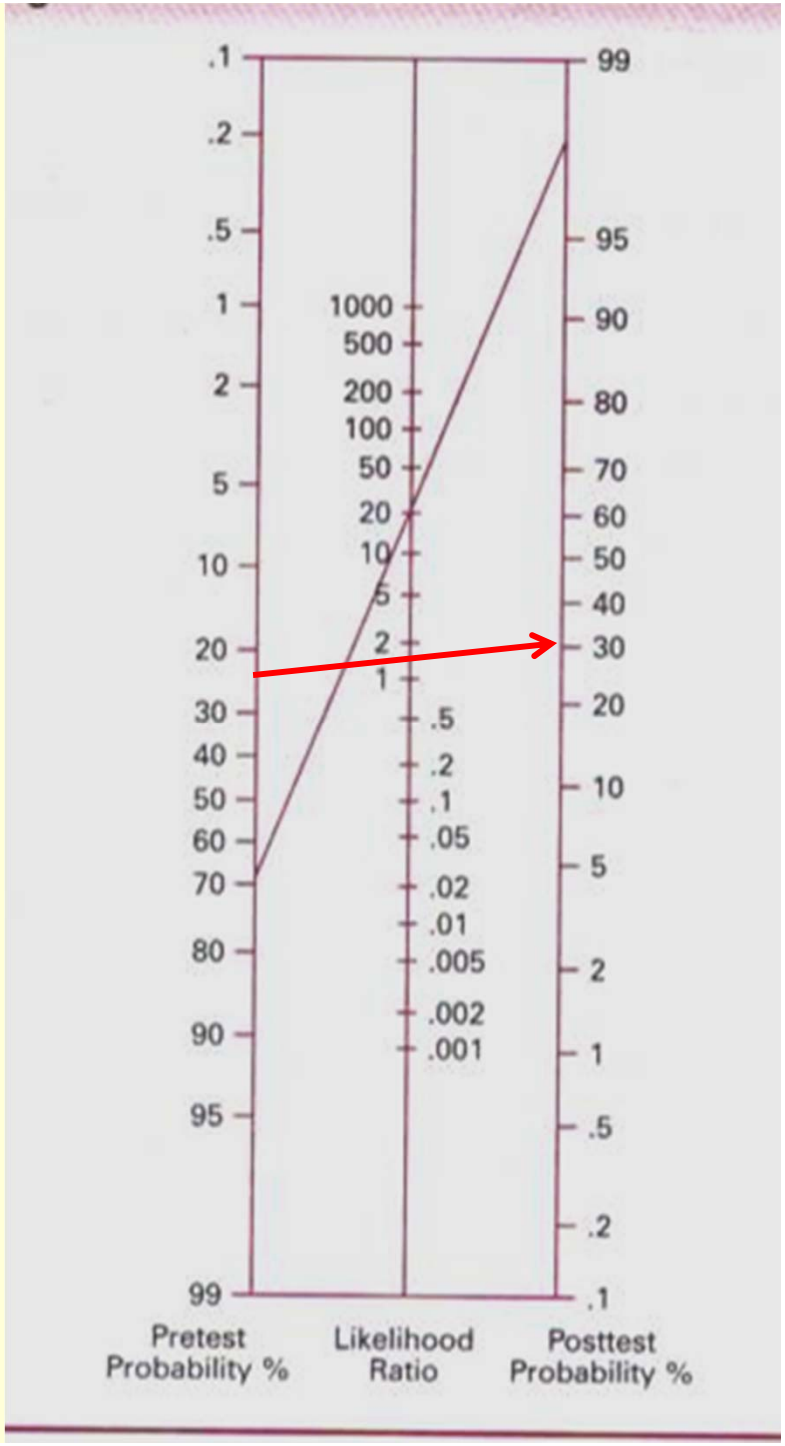


Table 2. Summary Accuracy of Demographic Variables to Predict Chronic Disabling Low Back Pain[a]

Definition	No. of Studies	References	Timing of Outcome Assessment	Median (Range)	
				Positive LR	Negative LR
Age					
≤40, <45, or <46 y vs older	6	23,25,26, 31,35,36	3 to 6 mo	0.94 (0.74-1.1)	1.1 (0.81-2.0)
≤40, <45, or <50 y vs older	6	23,27,29, 31,34,37	1 y	0.93 (0.62-1.0)	1.1 (0.99-1.8)
Sex					
Female vs male	9	23,25,26,28, 30,31,33, 35,36	3 to 6 mo	1.1 (0.72-1.4)	0.94 (0.66-1.3)
Female vs male	8	22,24,27,29, 31,34,37	1 y	1.3 (1.0-1.7)	0.73 (0.58-1.0)
Education					
No college education or not college graduate vs more education	7	23,25,26,30, 33,35,36	3 to 6 mo	1.0 (0.97-1.3)	0.76 (0.52-1.1)
No college education or not college graduate vs more education	4	23,27,29,37	1 y	1.1 (1.1-1.2)	0.65 (0.46-0.85)
Smoking status					
Current smoker vs not current smoker	3	23,25,26	3 to 6 mo	1.2 (1.0-1.6)	0.88 (0.71-0.97)
[b]	4	23,27,29,34	1 y		
Weight					
BMI >25 or ≥27 vs lower BMI	3	23,25,31	3 to 6 mo	0.91 (0.72-1.2)	1.0 (0.76-1.2)
BMI >25 or ≥27 vs lower BMI	2	23,31	1 y	0.84 (0.73-0.97)	1.1 (1.0-1.2)

JAMA 2010; 303 (13): 1295-1302

Sick leave, off work, or workers' compensation case					
Compensated work injury or sick leave vs not compensated work injury or sick leave	4	23,26,31,33	3 to 6 mo	1.3 (0.97-2.7)	0.88 (0.78-1.0)
Compensated work injury or seeking compensation vs not compensated or seeking compensation	5	23,24,27, 29,31	1 y	1.4 (1.2-1.8)	0.86 (0.37-0.93)
Work satisfaction					
Less vs more work satisfaction	3	23,25,26	3 to 6 mo	1.1 (0.64-1.8)	0.98 (0.94-1.2)
Less vs more work satisfaction	3	23,27,34	1 y →	1.5 (1.3-1.8)	0.88 (0.62-0.94)
Physical work demands					
Higher vs lower physical work demands	3	23,25,30	3 to 6 mo →	1.2 (1.1-1.6)	0.87 (0.85-0.89)
Higher vs lower physical work demands	2	23,37	1 y →	1.4 (1.2-1.7)	0.84 (0.83-0.85)

Table 3. Summary Accuracy of General Health, Psychiatric Comorbidities, and Prior Low Back Pain Episodes for Predicting Chronic Disabling Low Back Pain[a]

Definition	No. of Studies	References	Timing of Outcome Assessment	Median (Range)	
				Positive LR	Negative LR
General health or activity level					
Lower vs better health status	3	23,25,30	3 to 6 mo	1.6 (1.1-1.7)	0.73 (0.66-0.88)
Lower vs better health status	5	22,23,29, 34,37	1 y	1.8 (1.1-2.0)	0.85 (0.56-0.99)
Psychiatric comorbidities					
Higher vs lower score on psychiatric comorbidity scale	4	23,25,35,36	3 to 6 mo	1.9 (1.4-2.1)	0.69 (0.55-0.85)
Higher vs lower score on psychiatric comorbidity scale	4	22,23,29,37	1 y	2.2 (1.9-2.3)	0.85 (0.55-0.93)
Prior low back pain episodes					
More episodes of vs less or no prior back pain	6	23,25,26,28, 32,33	3 to 6 mo	1.0 (0.90-1.2)	0.88 (0.53-1.1)
More episodes of vs less or no prior back pain	5	23,27,29, 32,34	1 y	1.1 (0.95-1.2)	0.81 (0.32-1.1)

JAMA 2010; 303 (13): 1295-1302

Table 4. Summary Accuracy of Signs and Symptoms for Predicting Chronic Disabling Low Back Pain[a]

Definitions	No. of Studies	References	Timing of Outcome Assessment	Median (Range) LR
Baseline pain				
Intensity of pain	6	25,30,32,33, 35,36	3-6 mo	
High				1.7 (1.1-3.7)
Medium				0.86 (0.66-1.2)
Low				0.70 (0.07-0.86)
Intensity of pain	3	29,32,37	1 y	
High				1.3 (1.2-2.0)
Medium				0.78 (0.72-1.0)
Low				0.33 (0.08-0.97)
Baseline function				
Intensity of impairment	6	23,25,30,33, 35,36	3-6 mo	
High				1.4 (1.3-3.5)
Medium				1.3 (0.74-1.5)
Low				0.53 (0.18-1.1)
Intensity of impairment	3	23,29,37	1 y	
High				2.1 (1.2-2.7)
Medium				0.86 (0.85-1.7)
Low				0.40 (0.10-0.52)
Fear avoidance behaviors or coping strategies				
Intensity of fear avoidance	4	23,33,35,36	3-6 mo	
High				2.2 (1.5-4.9)
Medium				1.1 (1.0-1.5)
Low				0.46 (0.30-0.73)
Intensity of fear avoidance	2	23,37	1 y	
High				2.5 (2.2-2.8)
Medium				1.2 (1.2-1.3)
Low				0.39 (0.38-0.40)

JAMA 2010; 303 (13): 1295-1302

JAMA 2010; 303 (13): 1295-1302

				Positive LR	Negative LR
Radiculopathy[b]					
Leg pain or radiculopathy vs no leg pain or radiculopathy	5	23,25,26, 31,33	3-6 mo	→ 1.4 (1.1-1.7)	0.63 (0.52-0.93)
Leg pain or radiculopathy vs no leg pain or radiculopathy	7	22,23,27,29, 31,34,37	1 y	→ 1.4 (1.2-2.4)	0.82 (0.54-0.94)
Nonorganic signs or somatization					
More vs less somatization	1	23	3 mo	→ 2.5 (95% CI,1.8-3.4)	0.81 (95% CI, 0.74-0.89)
More vs less widespread pain or somatization	3	23,34,37	1 y	→ 3.0 (1.7-4.6)	0.71 (0.31-0.76)

Bottom Line
JAMA 2010; 303 (13): 1295-1302

A systematic approach for primary care patients with low back pain that includes an assessment for high levels of maladaptive pain coping behaviors, presence of nonorganic signs, high levels of baseline functional impairment, low general health status, and psychiatric comorbidities can increase the likelihood of correctly predicting the development of **persistent disabling low back pain** through 1 year.

Bottom Line

JAMA 2010; 303 (13): 1295-1302

- Low levels of fear avoidance and low baseline functional impairment are the most useful items for predicting likelihood of recovery.

Bottom Line

JAMA 2010; 303 (13): 1295-1302

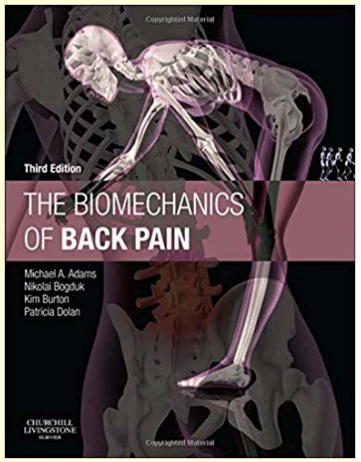
- Variables related to the work environment, baseline pain, and presence of radiculopathy are less useful for predicting worse outcomes.

- A history of **prior low back pain** episodes and **demographic variables** (age, sex, smoking status, weight, and educational level) are **not useful**.

Environmental/ Physical Risk Factors

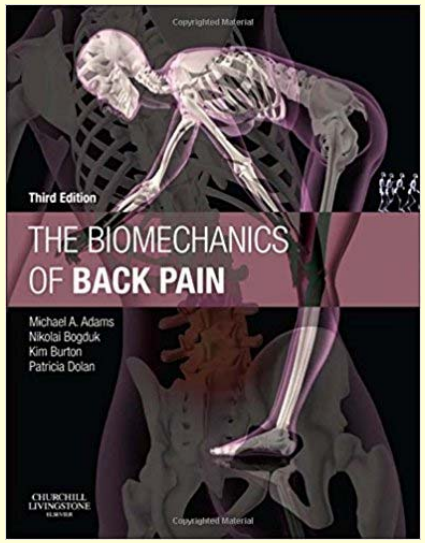
- The epidemiological studies available for review had **pain and disability as their main outcomes**, *rather than objectively demonstrable injury or damage*
- The correlation between symptomatology and pathology is **inconsistent.**

Adams M, Bogduk N, Burton K, Dolan P,
The Biomechanics of Back Pain, Third Edition,
Elsevier, 2013 page 54



Environmental/ Physical Risk Factors

- There is **insufficient scientific evidence** to conclusively establish that **any** occupational or ergonomic **risk factor** is actually **a medical cause** of working-age adult LBP



Adams M, Bogduk N, Burton K, Dolan P,
The Biomechanics of Back Pain, Third Edition,
Elsevier, 2013 page 54

Progression of LBP

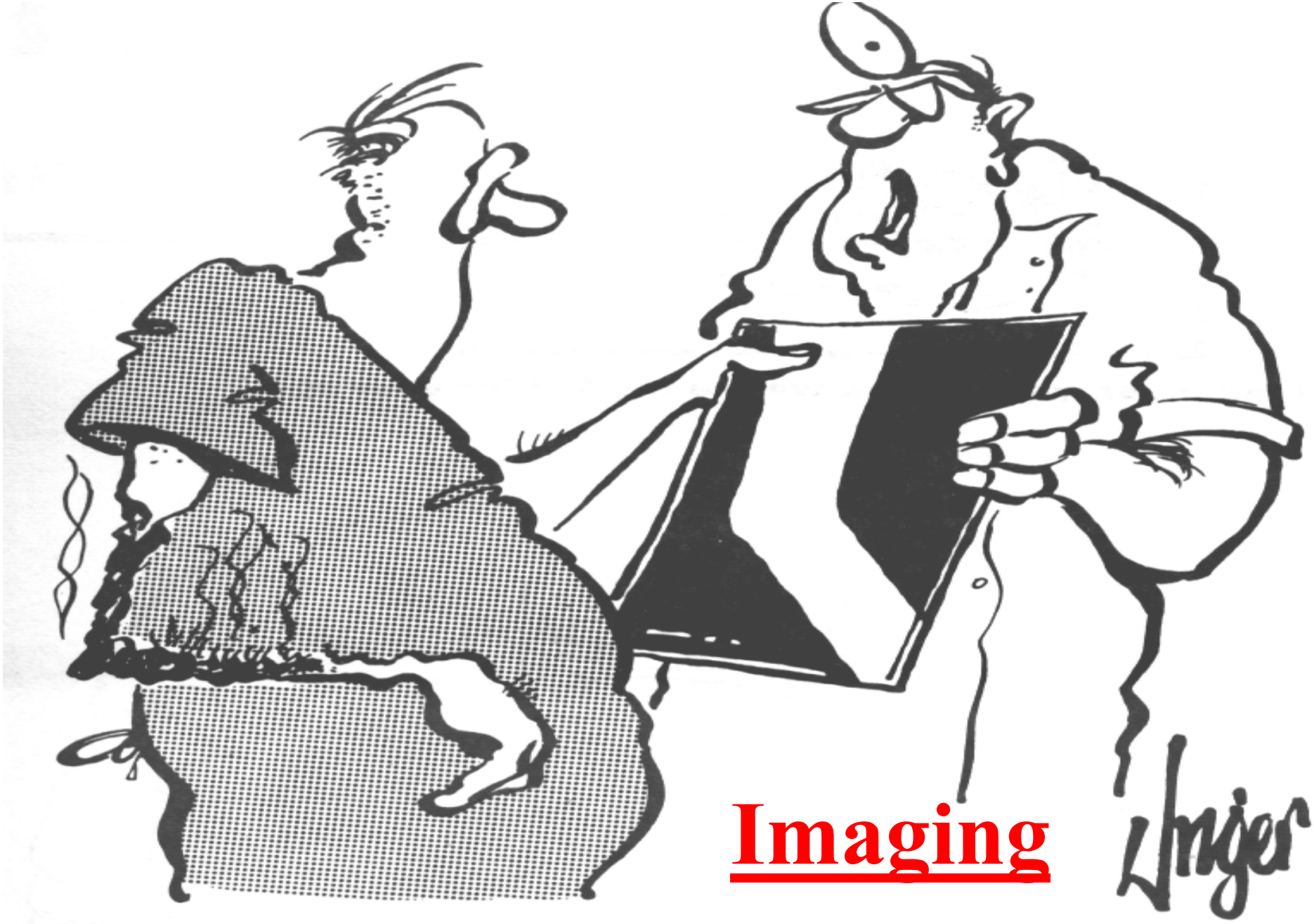
- "It is not clear what causes LBP in most people."
- "Progression of subclinical common backache or acute back pain to serious disabling LBP illness appears to be **associated with** various **nonstructural issues** such as emotional distress, poor coping strategies, compensation disputes, and other chronic pain problems.

Carragee E, et al. Are first-time episodes of serious LBP associated with new MRI findings? *The Spine Journal* 2006; 6: 624-635

Low Back Pain and Disability

- The "injury model" has transformed a largely benign symptom into a dire illness.
- "*Our findings **do not support** the concept that serious low back pain and disability stem from minor trauma, structural problems, **or the combination** of the two*."

Carragee et al; Does Minor Trauma Cause Serious Low Back Illness?
***Spine* 2006; 31 (25): 2942-2949 AND**
Are first-time episodes of serious LBP associated with new MRI findings?
***The Spine Journal* 2006; 6: 624-635**



"I'll have to X-ray your arm again. This one is overexposed."

Despite the Declaration of Independence

- "We hold these truths to be self-evident, that all RADIOLOGISTS are **NOT** created equal …"

Verification

- Herzog, R, et al. Variability in diagnostic error rates of **10 MRI centers** performing lumbar spine MRI examinations on the **same patient** within a **3-week period**. The Spine Journal 17 (2017) 554–561.
- The sample is a **63-year-old woman** with a history of low back pain and **right L5 radicular symptoms**. **[25 real findings]**
- Across all 10 study examinations, there were **49** distinct findings reported related to the presence of a distinct pathology at a specific motion segment.
- **Zero** interpretive **findings were reported in all 10 study examinations** and only one finding was reported in nine out of 10 study examinations.
- Of the interpretive findings, **32.7% appeared only once** across all 10 of the study examinations' reports.
- The average **false-negative** count per examination was **10.9**±2.9 out of **25** and the average **false-positive** count was **1.6**±0.9, which correspond to an average true-positive rate (sensitivity) of 56.4%±11.7 and miss rate of 43.6%±11.7.

Verification

- Herzog, R, et al. Variability in diagnostic error rates of 10 MRI centers performing lumbar spine MRI examinations on the same patient within a 3-week period. The Spine Journal 17 (2017) 554–561.
- **CONCLUSIONS: This study found marked variability in the reported interpretive findings and a high prevalence of interpretive errors in radiologists' reports** of an MRI examination of the lumbar spine performed on the same patient at 10 different MRI centers over a short time period. As a result, the authors conclude that **where** a patient obtains his or her MRI examination and **which radiologist** interprets the examination may have a direct impact on radiological **diagnosis, subsequent choice of treatment, and clinical outcome.**

Diagnostic Studies: Advanced Imaging

ACOEM:

- **NOT Recommended**
  - Discography – acute, subacute, chronic LBP or radicular pain syndromes (B)
  - MRI discography (C)
  - Myeloscopy – acute, subacute, chronic LBP, spinal stenosis, radicular pain syndromes or post-surgical back pain problems (I)

ODG 12/28/17 Low Back Chapter

- Discography: **NOT recommended**.
  - Low predictive value for success with lumbar fusion
  - May accelerate disc degeneration
    - Places "normal control discs" at risk
  - Patients with psychological/psychiatric illness at **increased risk of discography induced** chronic pain
    - Yet these are the patients most in need of a way to diagnose physical pain generator

Newest Series on **Discography in a Series on 1 level fusion**

- Staartjes VD et al (Netherlands) – Retrospective Review
  - The Spine J 2018; 18: 558-66
- 91 patients with 1 level DDD from 1 center over 7 years, BMI < 33. **[Ideal candidates]**
- **Discography with Discoblock FAILED to predict improvement.**
- Cites 4 studies with no predictive effect, 2 with benefit, 2 with long-term harm, and **"should therefore NOT be used in routine clinical practice … we have ceased using …for patient selection."**

Spine 2014: 39 (24): E1448-E1465
The Spine Journal 14 (2014) 2525–2545

Spine

SPINE Volume 39, Number 24, pp E1448-E1465

EPIDEMIOLOGY

Lumbar Disc Nomenclature: Version 2.0

Recommendations of the Combined Task Forces of the North American Spine Society, the American Society of Spine Radiology, and the American Society of Neuroradiology

David F. Fardon, MD,* Alan L. Williams, MD,† Edward J. Dohring, MD,‡§ F. Reed Murtagh, MD,¶ Stephen L. Gabriel Rothman, MD,‖ and Gordon K. Sze, MD**
This article is being simultaneously published in The *Spine Journal*.

- North American Spine Society
- American Society of Spine Radiology
- American Society of Neuroradiology

Analogies

- Of course you have headache,
  You have GRAY HAIR
  on visual imaging of your head !!
- Gray Hair also correlates with Type 2 Diabetes Mellitus

When you ORDER a MRI, **SAY**

- "You are **old enough** that we will see **aging changes** on your MRI.
- **Here is a list** of the aging changes commonly seen in volunteers who get a MRI done even though they say they have never had low back pain.
- **You will see some of these words** on your MRI report.
- My job is to figure out if the aging changes mean something, or **CORRELATE** with your symptoms."

Battié Spine 2004; 29: 2679–2690

Table 1. Prevalence of Disc-Related Degenerative Findings on MRI Images of the Lumbar Spine in "Asymptomatic Subjects"

Author, year	N	Age (years) [mean ± SD (range)]	Gender	Bulge	Protrusion	Extrusion	Reduced Signal Intensity	Reduced Disc Height	Annular Tears (HIZ)	Schmorl's Nodes
Salo, 1995	49	8 (0–14)	NA	—	—		22%	—	—	—
Gibson, 1986	20	19 (17–21)	50% M	—	—	—	20%	—	—	—
Tertti, 1991	39	15	44% M	—	3%	—	26%	3%	—	8%
Paajanen, 1989	34	20 ± 1	100% M	—	—	—	35%	—	—	—
Burns 1996	41	26 (21–31)	100% M	0–10% level	0–32%pe level	—	0–24% level	—	—	7–15% level
Weinreb, 1989	41	30 (19–40)	100% F	44	—	10%	—	—	—	—
Evans, 1989	59	30	52% M	—	—	—	—	37%	—	—
Schellhas, 1996	17	30 (22–54)	NA	—	—	0%	23%	—	6%	—
Weishaupt, 1998	60	35 (20–50)	50% M	20–28%	38–42%	18%	—	—	32–33%	—
Boos, 1995	46	36 (20–50)	74% M	51%	63%	13%	—	—	—	—
Stadnick, 1998	36	42 (17–71)	56% M	81%	33%	—	55%	—	56%	—
Boden, 1990	67	42 (20–80)	45% M	—	59%	24%	—	—	—	—
Boden, 1996 (L3S1)	67	42 (20–79)	NA	22% discs	—	—	54%	—	9% discs	—
Jensen, 1994	98	42 (20–80)	51% M	52%	27%	1%	—	—	14%	19%
Jarvik, 2001	148	54 (36–71)	78% M	64%	32%	6%	83%	56%	38%	—
Paajanen, 1997	216	(10–49)	51% M	—	—	—	44%	—	—	—
Parkkolla, 1993	60	(30–47)	NA	15% bpe	—	—	—	—	—	—
Danielson, 2001	43	(20–60)	49% M	—	26%	—	—	—	—	—
Hamanishi, 1994	106	(1–82)	NA	—	—	—	—	—	—	9%
Powell, 1986	302	(16–80)	100% F	11–13% bpe	—	—	6–79% age	—	—	—

NA = not available, % disc = % from discs studied; % level = % of subjects at a given intervertebral level; % age = % per age strata; bpe = bulges, protrusions, or extrusions; pe = protrusions or extrusions.
Note: no study of 'asymptomatic subjects' reported on the prevalence of vertebral rim osteophytes.

Brinjikji W, et al.

- Am J Neurorad 2015: 36 (4): 811-6
- Systematic Review
- 33 published articles
- 3110 **ASYMPTOMATIC** individuals

Table 1: Estimated number of patients by age used to inform prevalence of degenerative spine imaging findings in asymptomatic patients[a]

Imaging Finding	Age (yr)						
	20	30	40	50	60	70	80
Disk degeneration	273 (9)	604 (16)	415 (12)	311 (10)	80 (4)	20 (2)	19 (2)
Disk signal loss	46 (2)	142 (5)	352 (4)	73 (2)	35 (1)	15 (1)	14 (1)
Disk height loss	15 (1)	163 (5)	186 (5)	208 (5)	35 (1)	15 (1)	14 (1)
Disk bulge	55 (4)	101 (7)	151 (8)	123 (7)	66 (5)	24 (3)	22 (3)
Disk protrusion	87 (5)	468 (14)	490 (14)	363 (12)	86 (5)	19 (2)	17 (2)
Annular fissure	167 (5)	350 (5)	426 (7)	53 (3)	35 (3)	15 (1)	14 (1)
Facet degeneration	0 (0)	0 (0)	596 (3)	53 (3)	35 (3)	15 (1)	14 (1)
Spondylolisthesis	0 (0)	0 (0)	31 (1)	53 (1)	35 (1)	15 (1)	14 (1)

[a] The number of studies are in parentheses.

Table 2: Age-specific prevalence estimates of degenerative spine imaging findings in asymptomatic patients[a]

Imaging Finding	Age (yr)						
	20	30	40	50	60	70	80
Disk degeneration	37%	52%	68%	80%	88%	93%	96%
Disk signal loss	17%	33%	54%	73%	86%	94%	97%
Disk height loss	24%	34%	45%	56%	67%	76%	84%
Disk bulge	30%	40%	50%	60%	69%	77%	84%
Disk protrusion	29%	31%	33%	36%	38%	40%	43%
Annular fissure	19%	20%	22%	23%	25%	27%	29%
Facet degeneration	4%	9%	18%	32%	50%	69%	83%
Spondylolisthesis	3%	5%	8%	14%	23%	35%	50%

[a] Prevalence rates estimated with a generalized linear mixed-effects model for the age-specific prevalence estimate (binomial outcome) clustering on study and adjusting for the midpoint of each reported age interval of the study.

Am J Neurorad 2014: ePub Ahead of Print
10.317A/ajnr.A4173

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Disk bulge	30%	40%	50%	60%	69%	77%	84%
Disk protrusion	29%	31%	33%	36%	38%	40%	43%
Annular fissure	19%	20%	22%	23%	25%	27%	29%
Facet degeneration	4%	9%	18%	32%	50%	69%	83%
Spondylolisthesis	3%	5%	8%	14%	23%	35%	50%

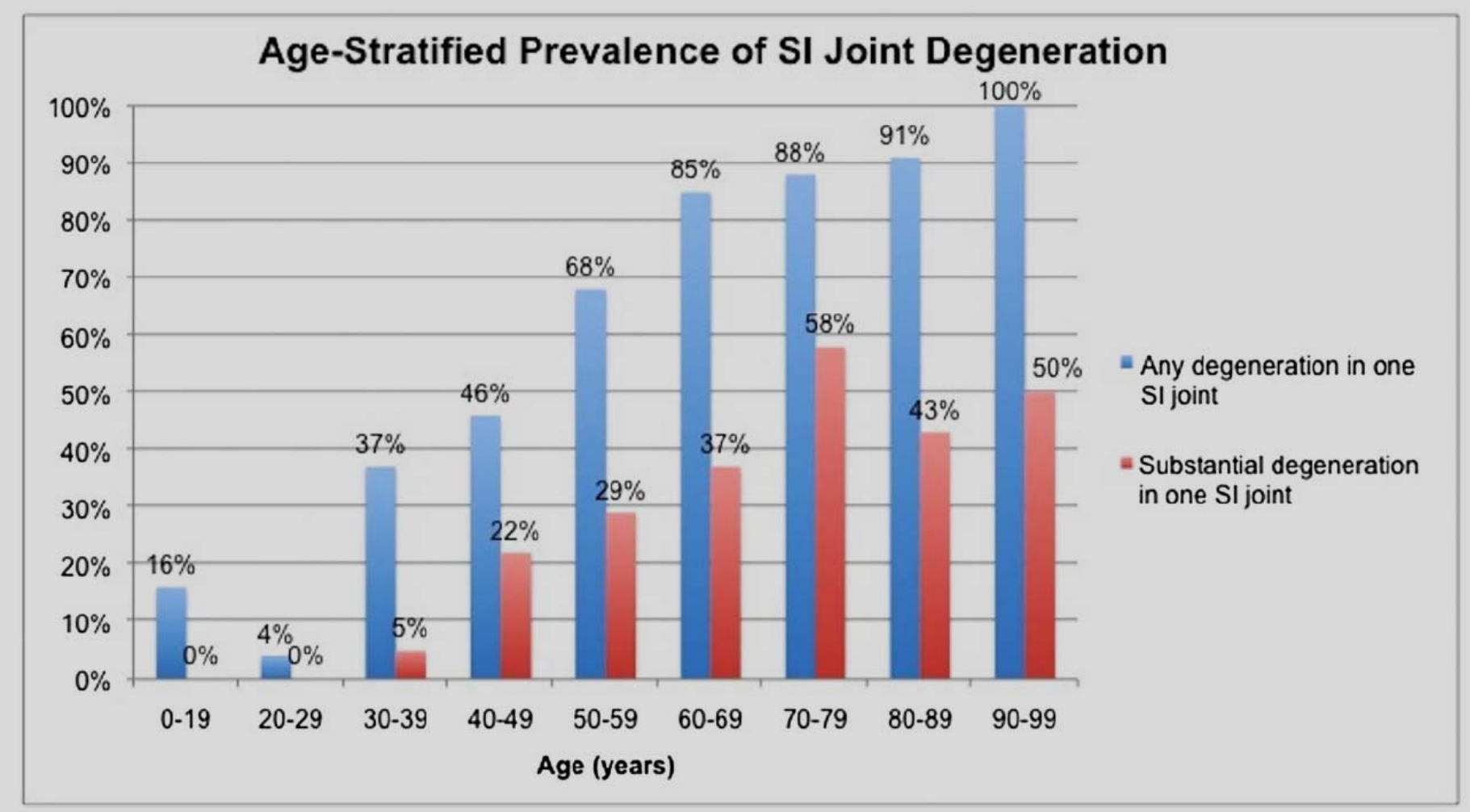
	Number of studies	OR (95% CI)	Prevalence asymptomatic (95% CI)	Prevalence symptomatic (95% CI)	p value	Hetero-geneity
Intervertebral disc degeneration-related outcomes						
Disc degeneration	12	2·2 (1·2–4·2)	34% (32–38)	57% (55–60)	0·01	High
Modic change	5	1·6 (0·5-5·4)	12% (10–15)	23% (22–27)	0·43	High
Modic type 1 change	2	4·0 (1·1-14·6)	3% (0·7–9)	7% (5–9)	0·04	Low
Internal disc rupture-related outcomes						
Annular fissure	6	1·8 (0·97–3·3)	11% (9–14)	20% (18–23)	0·06	High
High Intensity Zone	4	2·1 (0·7–6·0)	10% (7–13)	10% (8–13)	0·17	High
Disc displacement-related outcomes						
Disc bulge	3	7·5 (1·3–44·6)	6% (4–9)	43% (38–48)	0·03	High
Disc protrusion	9	2·7 (1·5–4·6)	19% (17–22)	42% (39–45)	0·00	High
Disc extrusion	4	4·4 (2·0–9·7)	2% (0·1–4)	7% (5–9)	<0·01	Low
Other outcomes						
Spondylolysis	2	5·1 (1·7–15·5)	2% (0–5)	9% (7–12)	<0·01	Low
Spondylolisthesis	4	1·6 (0·8–3·2)	3% (2–6)	6% (4–9)	0·20	Low
Central spinal canal stenosis	2	20·6 (0·1–798.8)	14% (10–19)	60% (55–64)	0·17	High

Data are modified from Brinjikji et al (2015).[20] Heterogeneity (I^2) was graded "low" only for "0" values since no CI for I^2 was presented. Prevalence data presented for reference only. OR=odds ratio.

Prevalence of SI Joint Degeneration in ASYMPTOMATIC Adults

- Eno JT, et al. JBJS 2015; 97: 932-6
- 373 adult CT scans of abdomen or pelvis with no history of back or hip problems
- Viewed in Bone Window, and DJD graded
- The prevalence of sacroiliac joint **degeneration was 65.1%,** with **substantial degeneration occurring in 30.5%** of asymptomatic subjects.
- The prevalence steadily increased with age, with 91% of subjects in the ninth decade of life displaying degenerative changes.

Eno JT, et al. JBJS 2015; 97: 932-6



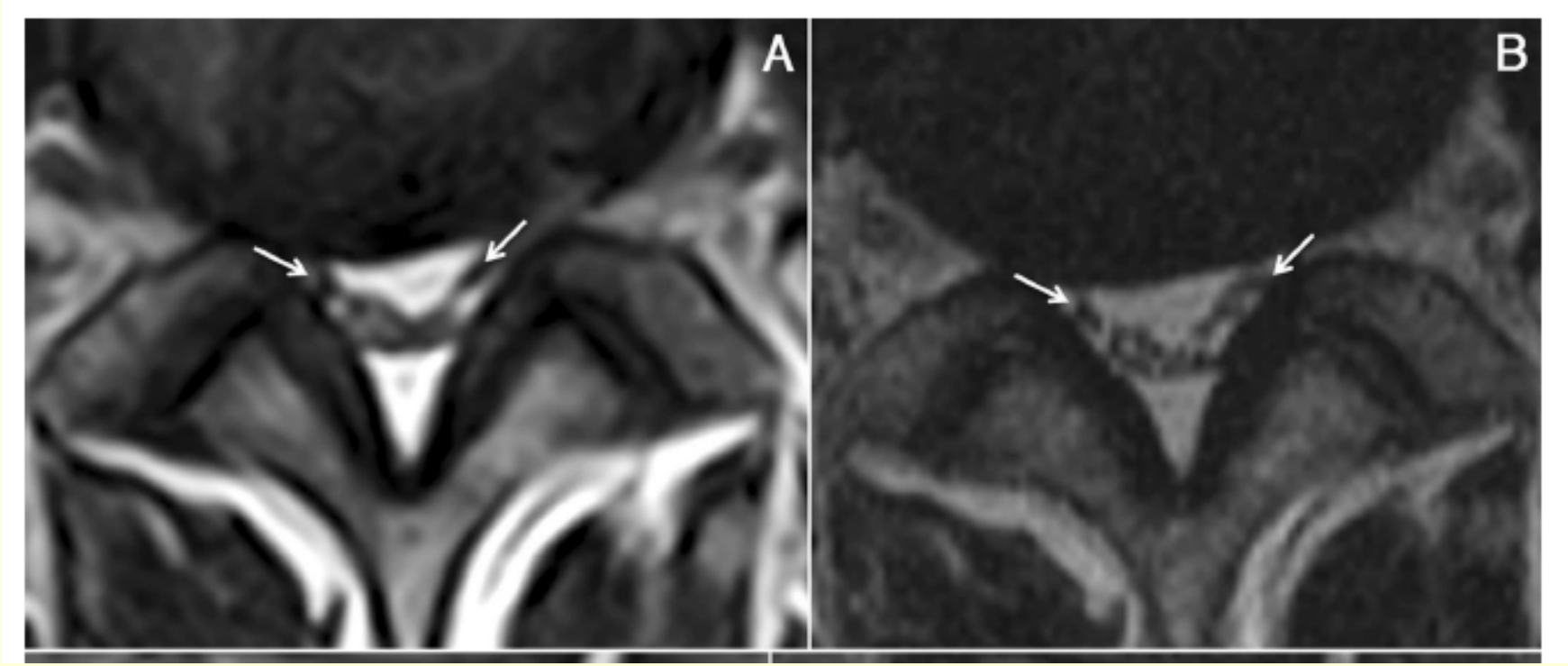
Nocebo

“ For each ailment that doctors cure,
they produce 10 others
in healthy individuals
by inoculating them
with the pathogenic agent,
1000 times more virulent
than all microbes –
idea they are ill.”

– Proust 1880’s

Crude Analogy:

Higher strength Magnet Yields more Pixels on the image



- T2 images: 0.25T 3.0T
- Lee RKL, et al. Spine 2015; 40 (6): 382-91

Lee RKL, et al. Spine 2015; 40 (6): 382-91

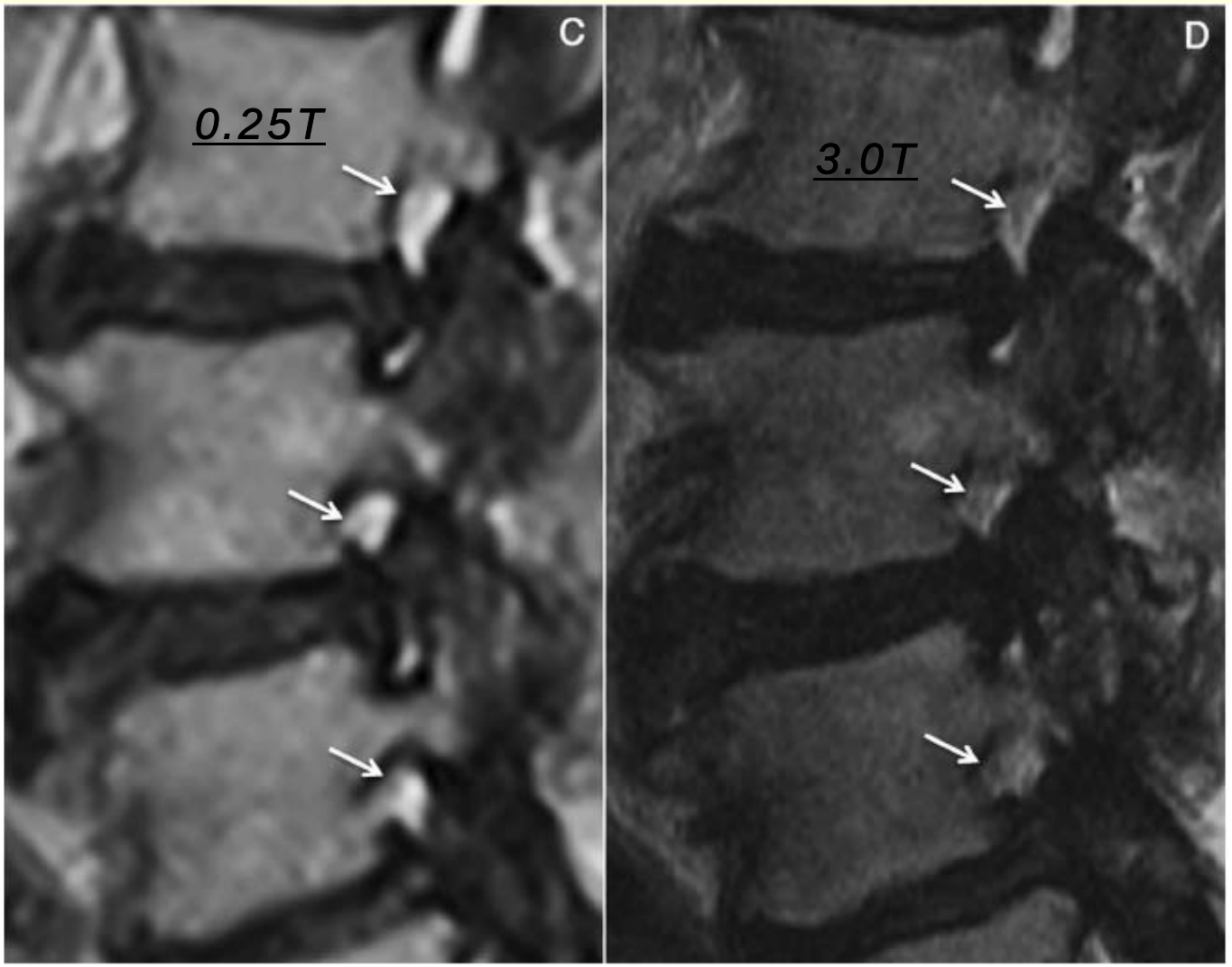
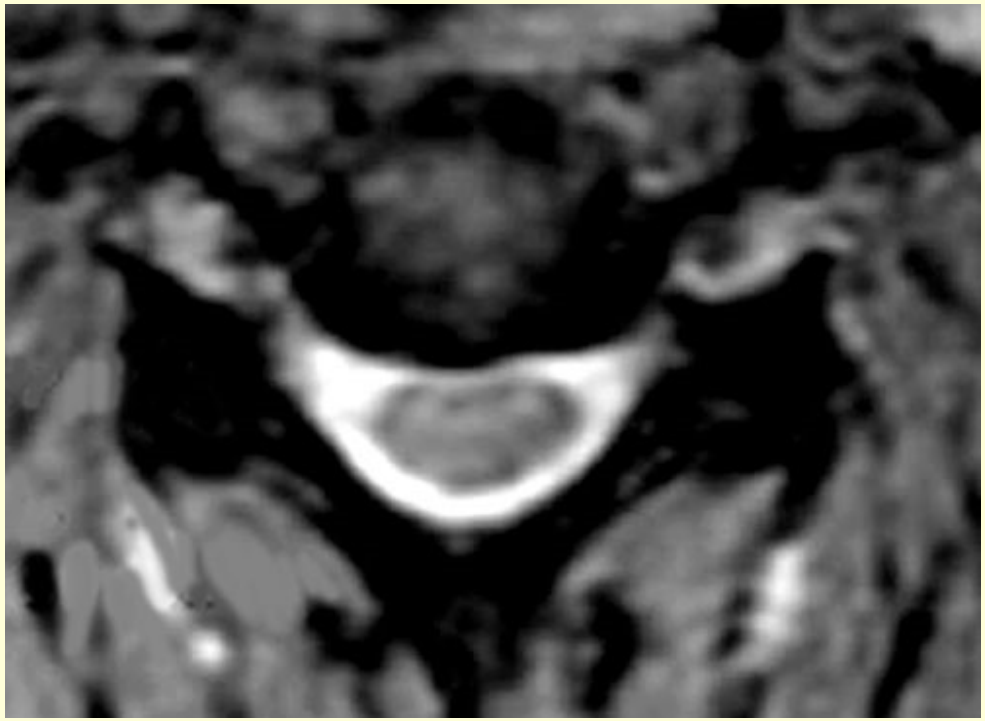
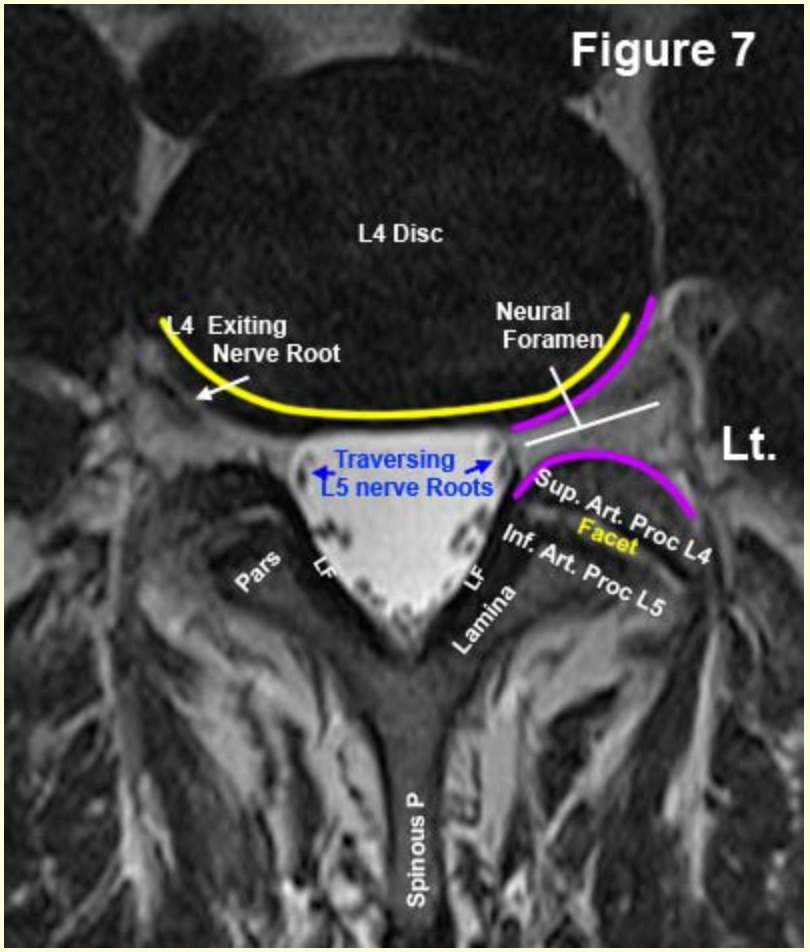


Figure 6. **A** and **B**, Corresponding axial T2-weighted magnetic resonance (MR) images at 0.25T (A) and 3.0T (B). The descending nerve roots (arrows) are better shown on 3.0T than on 0.25T MR images. **C** and **D**, Corresponding parasagittal T2-weighted MR images at 0.25T (A) and 3.0T (B). The exiting nerve roots (arrows) are better shown on 3.0T than on 0.25T MR images.

Crude Analogy: Higher strength Magnet Yields more Pixels on the image

- 0.5T vs. 3.0 T





3Tesla MRI

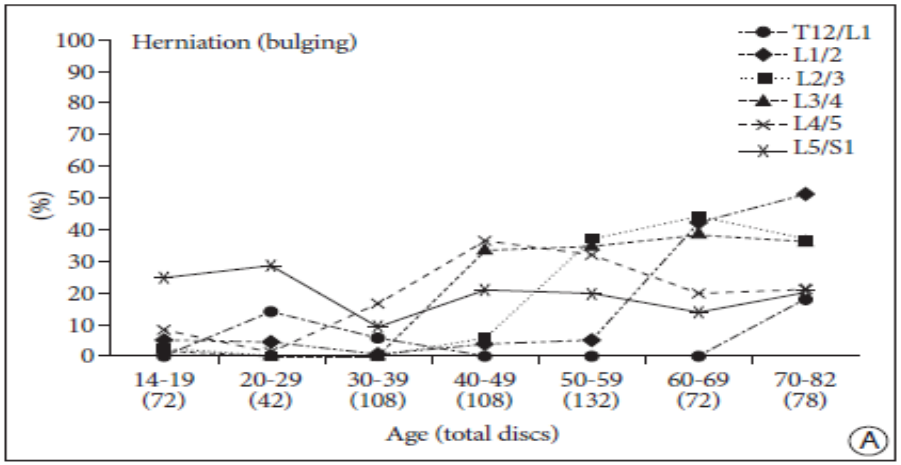
- **3 Tesla** MRI has higher resolution than 1.5T
- BUT, NO significant improvement in Spinal Diagnosis.
- J Korean Neurosurg Soc **2013**; 53: 31-38
  - FIRST report of 3T MRI in asymptomatic adults
  - **102 asymptomatic adults** age 14-83 (mean 46)
  - Read by 2 neurosurgeons, 1 neuroradiologist
- **Prevalence of Disc Herniation 81%,** Annular Fissure 76%, and Disc Degeneration 76%

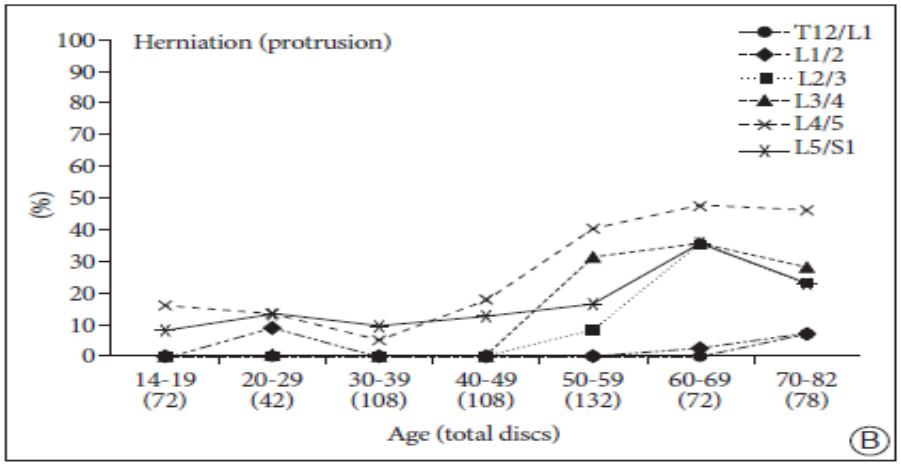
J Korean Neurosurg Soc 53 : 31-38, 2013

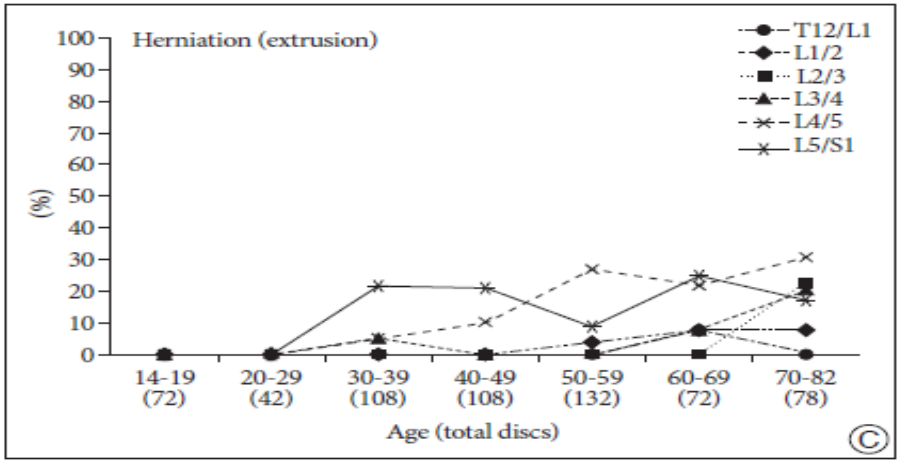
Table 4. Abnormal disc degeneration findings according to person and disc count

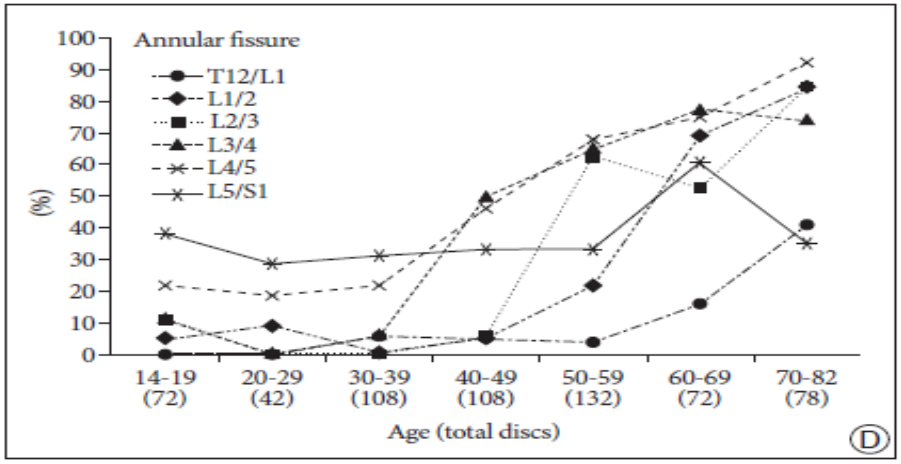
Degeneration	Finding	Person count (n=102)	Disc count (n=612)
Herniation	Bulging	61.3 (60.1%)	103.0 (16.8%)
	Protrusion	46.3 (45.4%)	72.7 (11.9%)
	Extrusion	31.7 (31.0%)	43.0 (7.0%)
	Sequestration	0 (0.0%)	0 (0.0%)
Annular fissure		77.7 (76.1%)	204.3 (36.0%)
High-signal intense zone		37.0 (36.3%)	49.3 (8.1%)
Nucleus degeneration	G3-6*	77.3 (75.8%)	234.7 (38.3%)

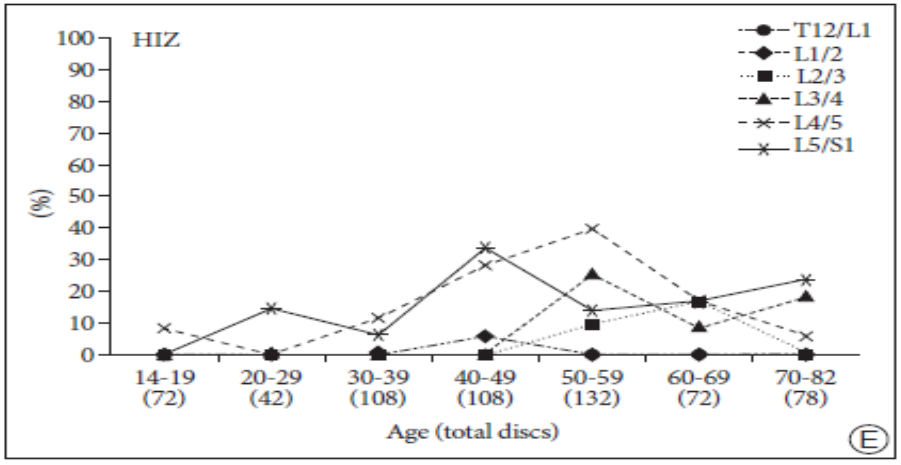
*Advanced grade

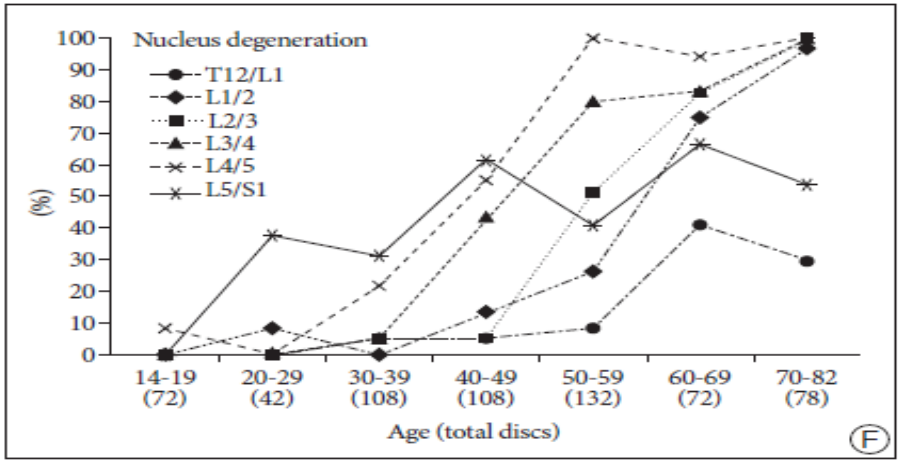

Herniation (bulging)
T12/L1
L1/2
L2/3
L3/4
L4/5
L5/S1
(%)
100
90
80
70
60
50
40
30
20
10
0
14-19 (72)
20-29 (42)
30-39 (108)
40-49 (108)
50-59 (132)
60-69 (72)
70-82 (78)
Age (total discs)
A


Herniation (protrusion)
T12/L1
L1/2
L2/3
L3/4
L4/5
L5/S1
(%)
100
90
80
70
60
50
40
30
20
10
0
14-19 (72)
20-29 (42)
30-39 (108)
40-49 (108)
50-59 (132)
60-69 (72)
70-82 (78)
Age (total discs)
B


Herniation (extrusion)
T12/L1
L1/2
L2/3
L3/4
L4/5
L5/S1
(%)
100
90
80
70
60
50
40
30
20
10
0
14-19 (72)
20-29 (42)
30-39 (108)
40-49 (108)
50-59 (132)
60-69 (72)
70-82 (78)
Age (total discs)
C


Annular fissure
T12/L1
L1/2
L2/3
L3/4
L4/5
L5/S1
(%)
100
90
80
70
60
50
40
30
20
10
0
14-19 (72)
20-29 (42)
30-39 (108)
40-49 (108)
50-59 (132)
60-69 (72)
70-82 (78)
Age (total discs)
D


HIZ
T12/L1
L1/2
L2/3
L3/4
L4/5
L5/S1
(%)
100
90
80
70
60
50
40
30
20
10
0
14-19 (72)
20-29 (42)
30-39 (108)
40-49 (108)
50-59 (132)
60-69 (72)
70-82 (78)
Age (total discs)
E

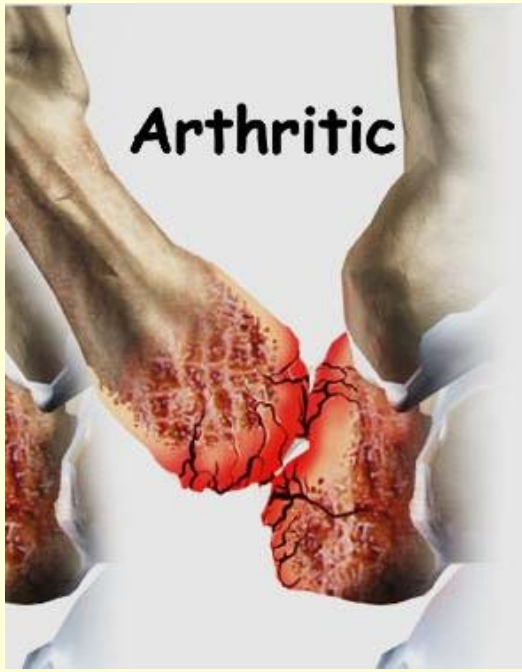

Nucleus degeneration
T12/L1
L1/2
L2/3
L3/4
L4/5
L5/S1
(%)
100
90
80
70
60
50
40
30
20
10
0
14-19 (72)
20-29 (42)
30-39 (108)
40-49 (108)
50-59 (132)
60-69 (72)
70-82 (78)
Age (total discs)
F

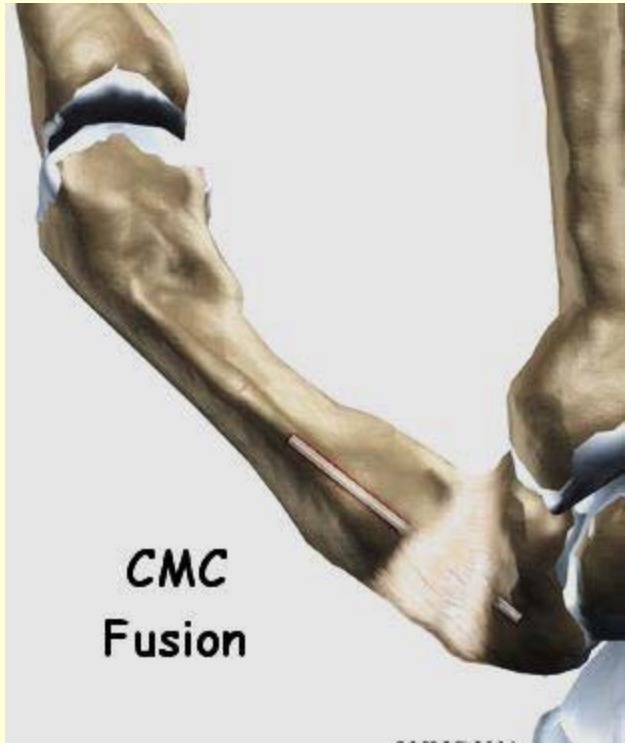
Fusion

Make 2 or more bones,

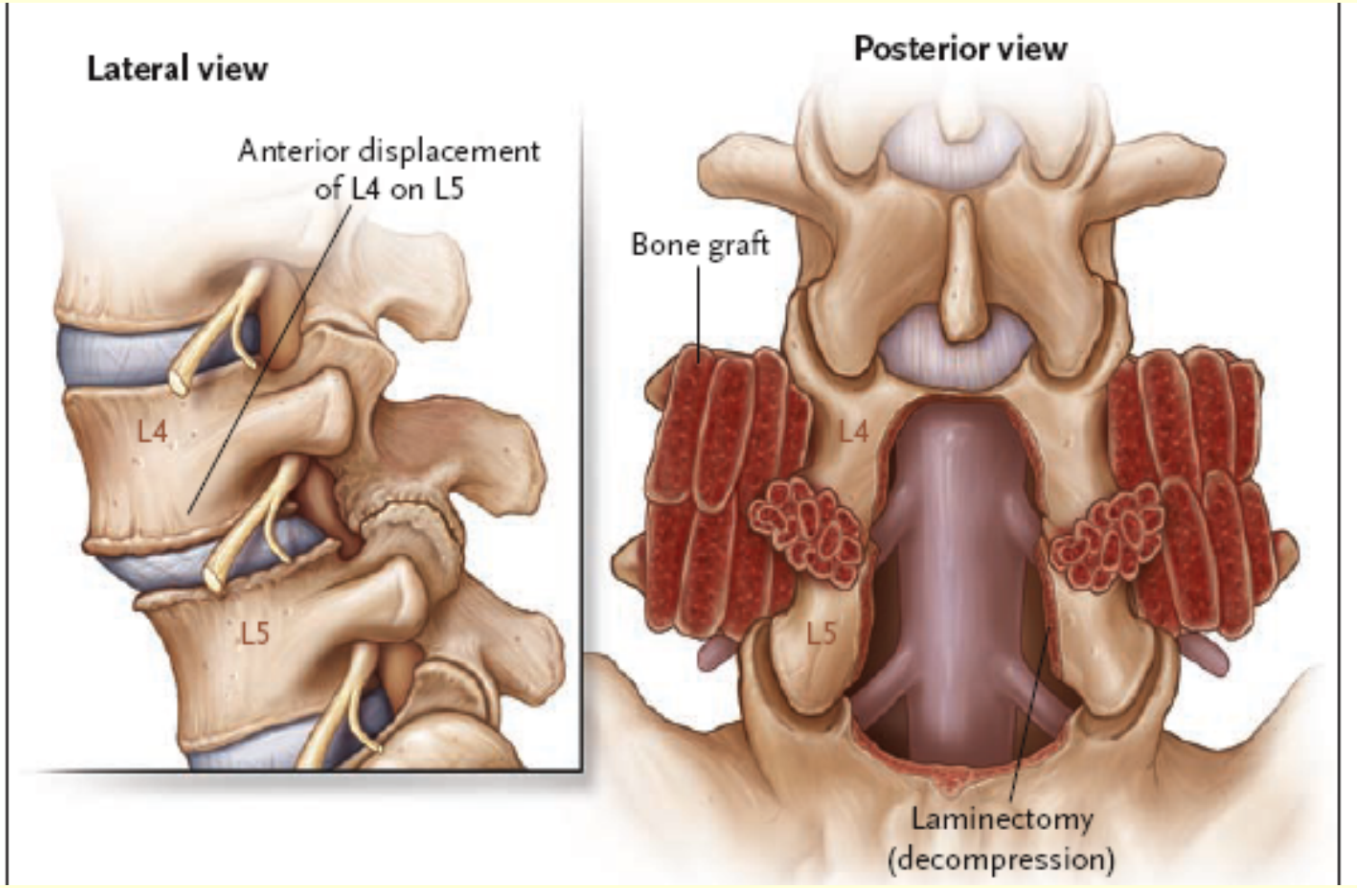
at a joint,

Grow together



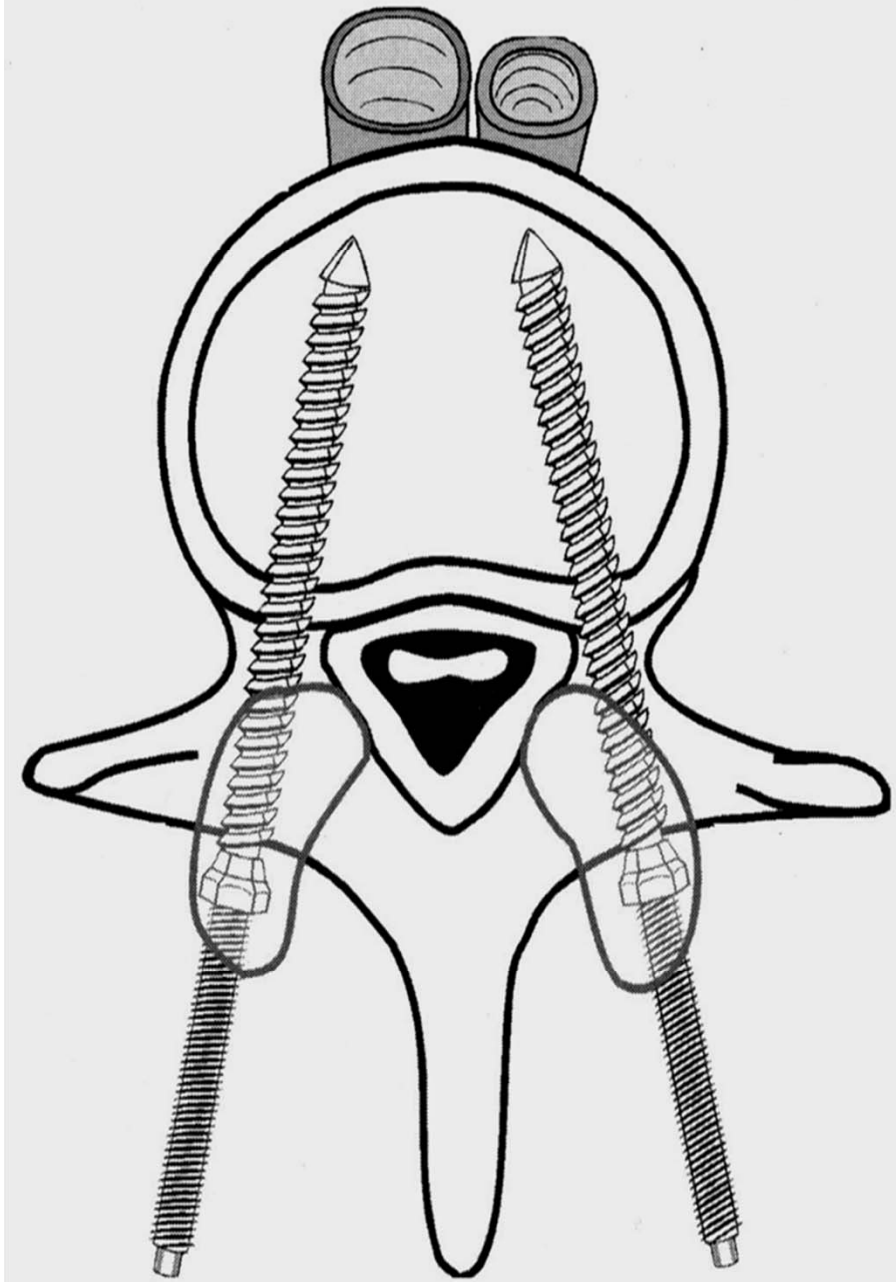


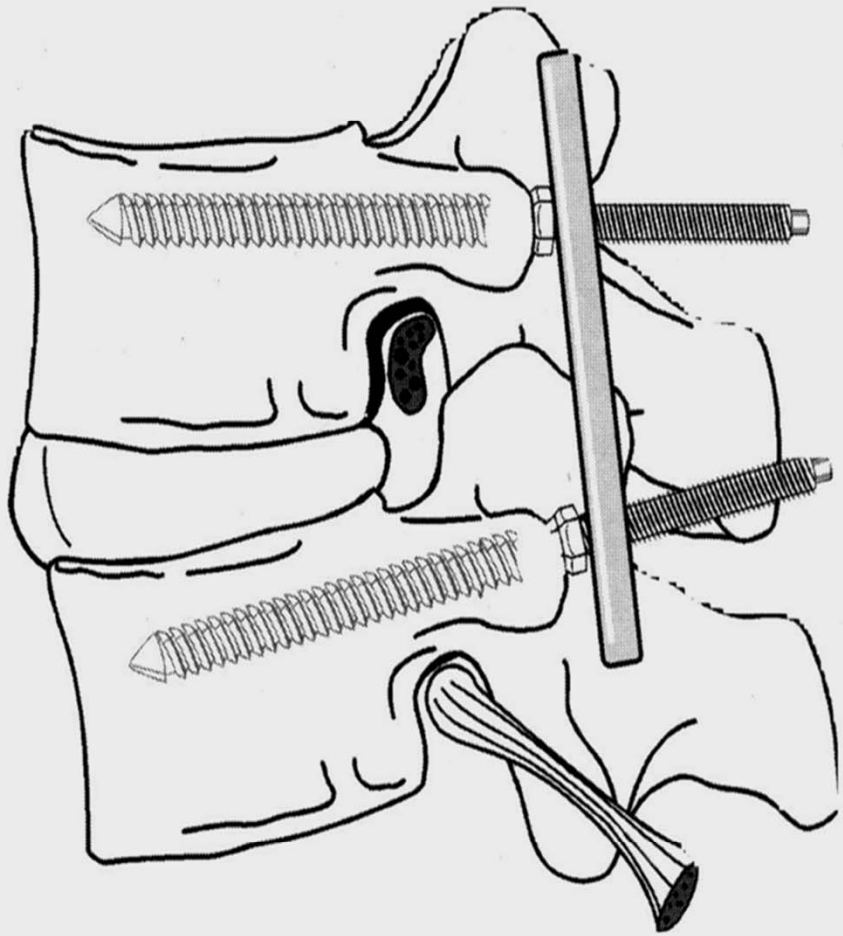
Spinal Fusion

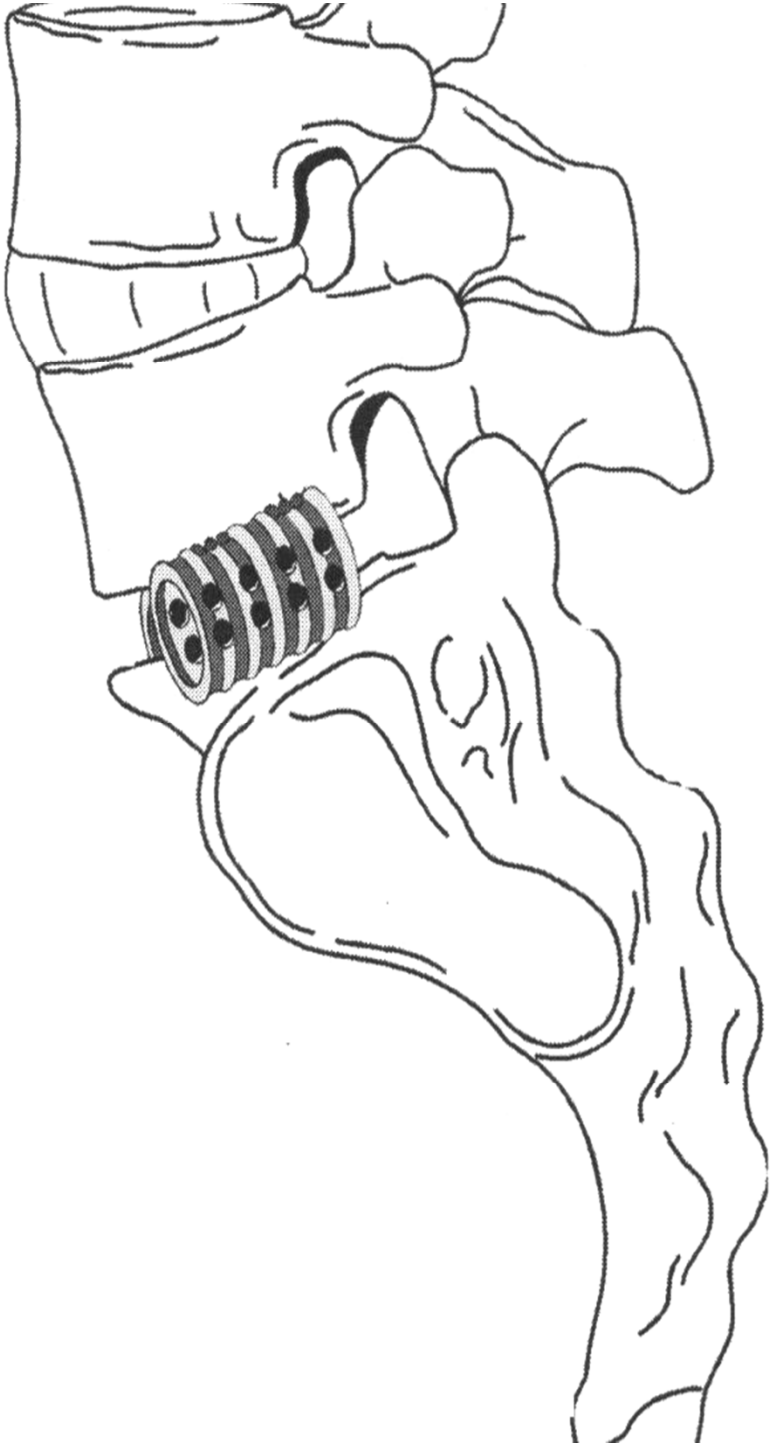


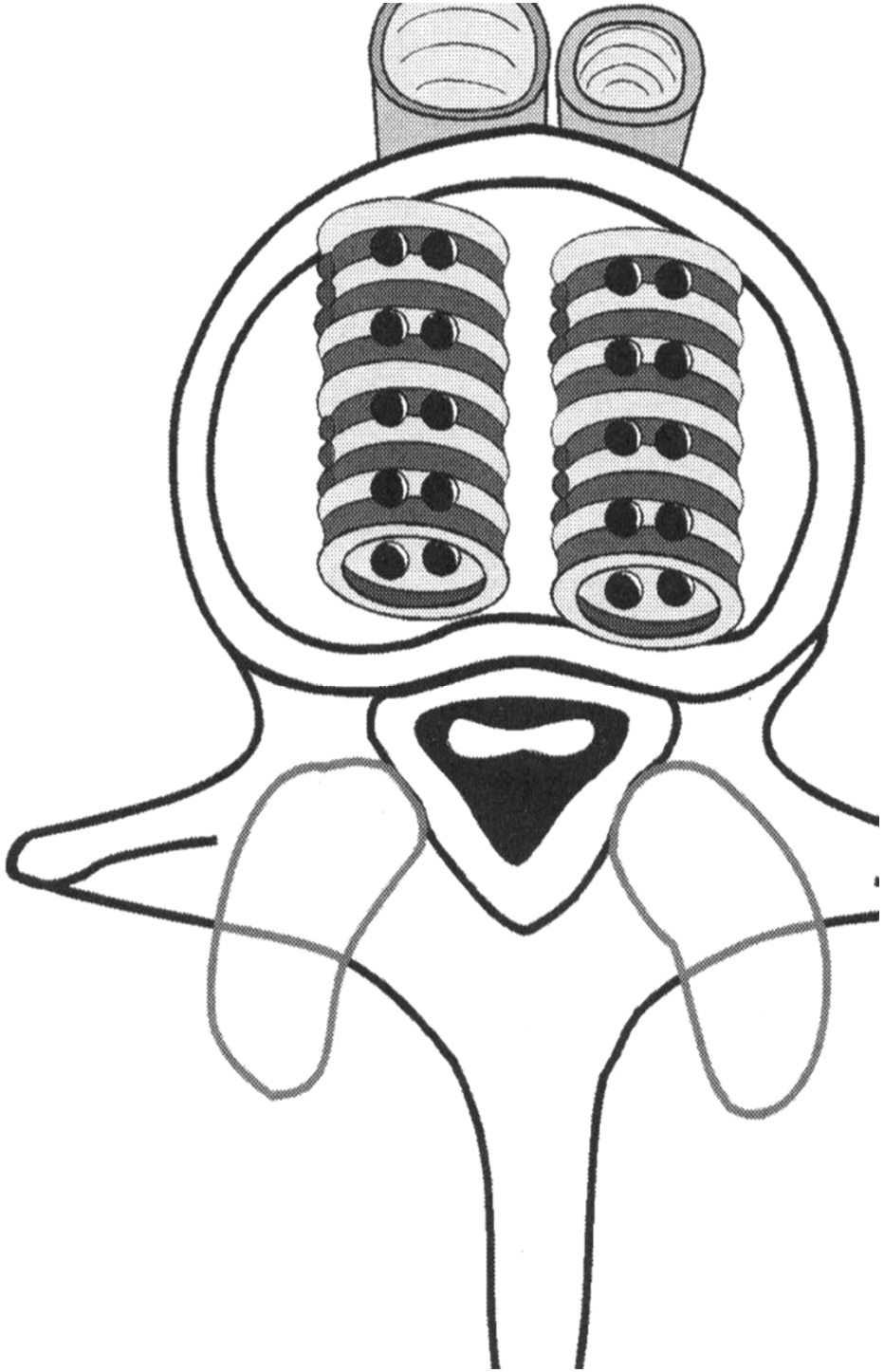
Evidence: There are 12 systematic reviews, 1 guideline, 31 RCTs, and 1 other study incorporated in this analysis.

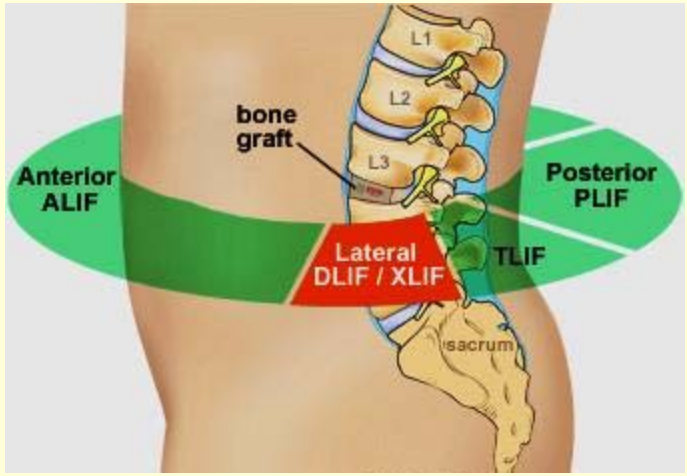
Deyo RA *N Engl J Med*. 2007;356(22):2239-43.

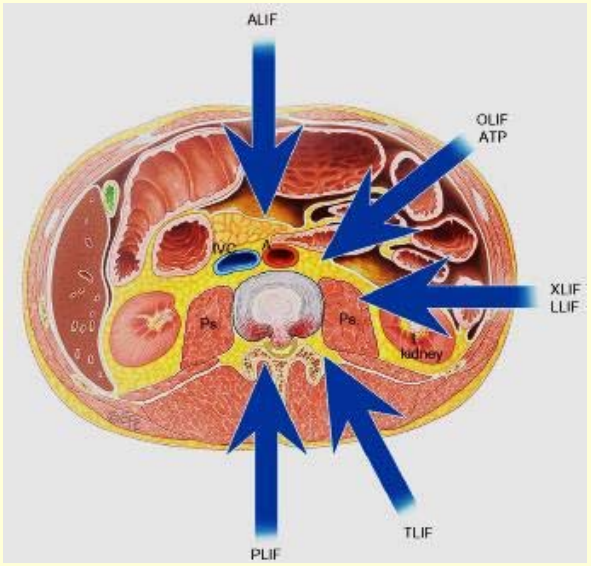




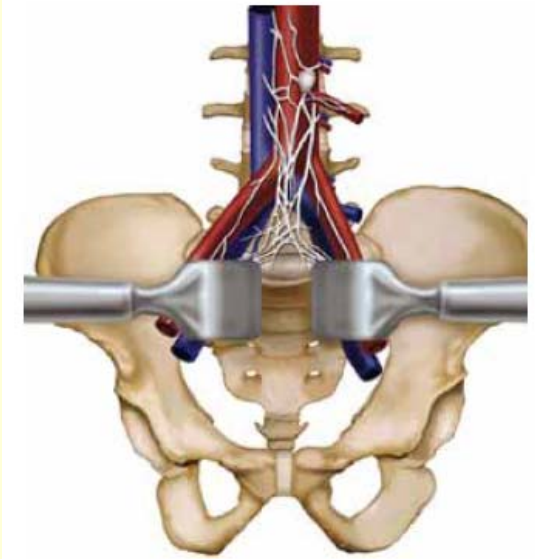


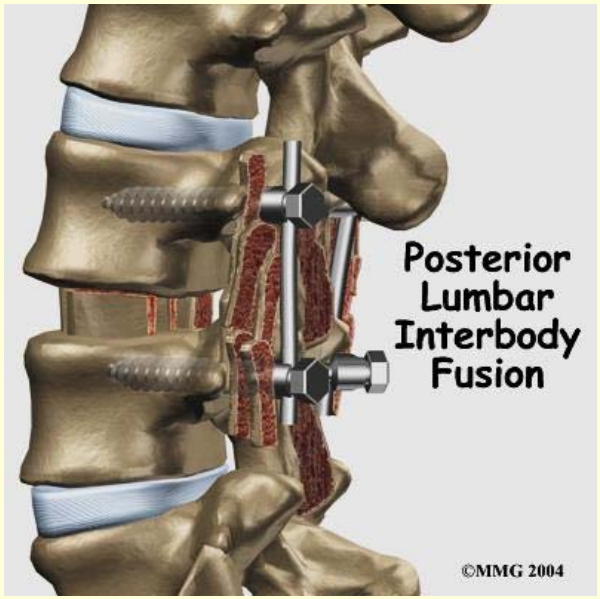






Anterior Approach





TLIF

LLIF

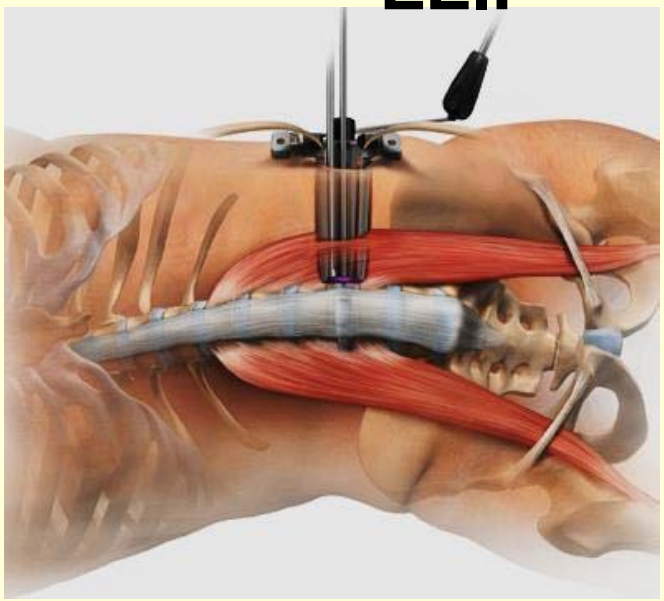


Table 2.13: Trends in Spinal Fusion Procedures, United States 1998-2011

ICD-9-CM	Description	Year	Number of Discharges with Procedure [1]	Rate of Year-to-Year Increase in Patients	Estimated Population Aged 18 & Over [2]	Rate Per 100,000 Population Aged 18 & Over [2]	Mean Age of Patient	Mean Length of Stay	Mean Hospitalization Charge [3]	Rate of Year-to-Year Increase in Mean Charge	Total Hospitalization Charges (in Billions)	Rate of Year-to-Year Increase in Total Hospital Charges
81.00-81.08	Spinal Fusion	1998	204,000		200,345,000	109.57	49.0	4.7	$26,000		$5.35	
		2000	242,000	18%	209,128,094	125.93	49.4	4.3	$32,000	21%	$7.18	34%
		2002	289,000	20%	215,122,788	150.07	50.2	4.4	$42,000	29%	$11.87	65%
		2004	307,000	6%	220,398,637	139.29	51.8	4.5	$56,000	34%	$16.87	42%
		2006	354,000	15%	224,769,279	169.02	53.2	4.2	$77,000	38%	$27.17	61%
		2011	457,442	29%	235,205,323	221.51	55.7	3.8	$102,000	32%	$46.43	71%
13-Year Rate of Change				124%						285%		768%
81.30-81.393	Spinal Refusion [4]	1998	12,000		200,345,000	5.90	47.1	4.6	$26,000		$0.30	
		2000	13,000	12%	209,128,094	6.36	49.0	5.4	$39,000	49%	$0.47	57%
		2002	19,000	43%	215,122,788	9.47	50.0	4.4	$46,000	20%	$0.86	83%
		2004	19,000	1%	220,398,637	8.62	52.7	4.8	$63,000	37%	$1.18	37%
		2006	20,000	4%	224,769,279	9.47	53.8	5.0	$96,000	52%	$1.90	62%
		2011	30,900	57%	235,205,323	14.46	56.7	4.7	$123,000	28%	$3.81	100%
13-Year Rate of Change				164%						375%		1169%
81.00-81.08 + 81.30-81.393	Total	1998	214,000		200,345,000	115.48	48.9	4.7	$26,000		$5.59	
		2000	253,000	18%	209,128,094	132.28	49.4	4.3	$32,000	22%	$7.53	35%
		2002	304,000	20%	215,122,788	159.54	50.2	4.3	$42,000	29%	$12.50	66%
		2004	321,000	5%	220,398,637	148.37	51.8	4.5	$56,000	34%	$17.87	43%
		2006	373,000	16%	224,769,279	178.49	53.2	4.2	$77,000	38%	$28.72	61%
		2011	488,300	31%	235,205,323	235.96	55.8	3.9	$103,000	35%	$50.52	76%
13-Year Rate of Change				128%						294%		804%

[1] Up to 15 procedures per patient are included in years 1998 to 2011; multiple spine procedures per patient can be coded. Total procedures reported were greater than 1 million for the 488,300 patient discharges. Discharges with a spinal refusion have been removed from spinal fusions discharges.

[2] Computed from U.S. Census population estimates released July 1st of each year (www.census.gov).

[3] "Charge" refers to hospitalization charges and does not include professional (i.e., physician fees), drugs or non-covered charges. Due to patient discharges with multiple procedures, total charges for combined fusion and refusion patients is the most valid estimate. Mean charges for patients with a spinal refusion procedure were typically higher than for those with spinal fusion only.

[4] Prior to 2002, spinal refusion procedures were coded to the single code, 81.09. In 2002, this code was dropped and multiple codes implemented. Nearly all spinal refusion patient discharges also underwent spinal fusion procedures; however, discharges with a spinal refusion have been removed from spinal fusions discharges to produce a more accurate number of new fusion procedure discharges.

Source: HCUP Nationwide Inpatient Sample (NIS). Healthcare Cost and Utilization Project (HCUP). 1998-2011. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/nisoverview.jsp

Enlarge Part of Prior Table

- Shows how lumbar fusion has increased in incidence over time

ICD-9-CM	Description	Year	Number of Discharges with Procedure [1]	Rate of Year-to-Year Increase in Patients	Estimated Population Aged 18 & Over [2]	Rate Per 100,000 Population Aged 18 & Over [2]	Mean Age of Patient
81.00-81.08	Spinal Fusion	1998	204,000		200,345,000	109.57	49.0
		2000	242,000	18%	209,128,094	125.93	49.4
		2002	289,000	20%	215,122,788	150.07	50.2
		2004	307,000	6%	220,398,637	139.29	51.8
		2006	354,000	15%	224,769,279	169.02	53.2
		2011	457,442	29%	235,205,323	221.51	55.7
13-Year Rate of Change				124%			

www.hcup-us.ahrq.gov/nisoverview.jsp

"Conflict of Interest" Disclosure

- **The** Home Run I Remember
- **1980** I did a L5-S1 fusion on "Donald" after he had been off work for 6 months following a lifting back strain in a widget factory.
  - X-ray > 50% loss of disc height at age < 30.
  - He returned to full-duty work pain free at 6 months
- In 2010 he returned to see me with a new rotator cuff tear lifting at work.
  - He stated he **had not had back pain for 30 years**.

At Bats per Home Run: Wikipedia

- Totals are current through the end of the 2016 season, minimum 3000 plate appearances.[1]
- Mark McGwire - 10.61
- Babe Ruth - 11.76
- Barry Bonds - 12.92
- Jim Thome - 13.76
- Ralph Kiner - 14.11

Some Surgeons are Better
At Selecting Patients for Surgery
At the Technical Details of Surgery

At Bats per Home Run 2017

95	Yadier Molina	St. Louis Cardinals	C	27.8
96	Andrew Benintendi	Boston Red Sox	LF	28.0
97	Avisail Garcia	Chicago White Sox	RF	28.8
98	Byron Buxton	Minnesota Twins	CF	29.0
99	Miguel Cabrera	Detroit Tigers	1B	29.3
100	Brett Gardner	New York Yankees	LF	29.4

At Bats per Home Run 2017

Player`	HR/At Bat	Equals 1 HR per # At Bats
Dee Gordon	2/653	326
Brock Holt	0/140	∞
Kelby Tominson	1/104	104

Patients Electing Spine Surgery are Hoping for a "Home Run"

Are Most Surgeons able to Select the proper surgical candidate And Cure Low Back Pain in Workers' Compensation Populations?

Spine 2015; 40 (14): 1140-7
14 of 16 studies had sub-optimal outcomes

TABLE 4. Studies Identified Comparing Workers' Compensation and Nonworkers' Compensation Outcomes After Lumbar Spinal Fusion

Lumbar Fusion

Authors	Country	Year	Design	Surgery	Diagnosis	Number of Patients	Follow-up (mo)	Outcomes	Results
Dzioba and Doxey *et al*[19]	Canada	1984	P	PLF	DS	17	12	Pain score	43% of WC patients had no relief of pain or made worse
Hanley and Levy[20]	United States	1988	R	PLF	IS	26	25	Functional results	WC had a profoundly negative influence on outcome
Greenough *et al*[21]	United Kingdom	1994	P	ALIF	DS	151	24	LBOS	WC-significant prognostic factor in outcomes
Penta and Fraser[23]	Australia	1997	P	ALIF	DS	103	240	LBOS	WC worse at 2 years but dissipates over 10 yr
Vaccaro *et al*[22]	United States	1997	R	PLF	DS	24	18	Outcome rating	WC strongly associated with poor operative results
Hinkley and Jaremko[18]	United States	1997	P	ALIF/PLF	DS	81	24	VAS	Good results in 91% of WC patients
Slosar *et al*[24]	United States	2000	R	ALIF/PLF	DS	73	24	NOQ	Non-WC associated with progression of symptoms
Hodges *et al*[17]	United States	2001	R	PLF	DS	36	12	SF-36	WC had significantly lower SF-36.
Fritzell *et al*[25]	Sweden	2001	RCT	PLF/PLIF/ ALIF	DS	294	24	VAS/ODI	WC patients had inferior results
Deberard *et al*[26]	United States	2001	R	PLF	DS	185	24	RMDQ/SCI/SF-20	Poor results with a 24% reoperation rate
Madan and Boeree[28]	United Kingdom	2003	P	ALIF/PLIF	DS	49	24	ODI/VAS	WC had significantly worse outcomes
Schiffman *et al*[27]	United States	2003	R	PLIF	DS	71	12	SF-36/patient satisfaction	WC results comparable with normative data scores
Trief *et al*[29]	United States	2006	P	PLF	DS/FS	155	24	SF-36/VAS/ODI	WC worse in terms of relief of leg pain
Carreon *et al*[31]	United States	2010	CC	PLF	DS	60	24	ODI/SF-36/VAS	WC has significantly less improvement
Kong *et al*[30]	South Korea	2010	R	PLF/PLIF/ ALIF	DS	22	60	VAS/ODI	WC was a predictor for poor outcome
Nguyen *et al*[32]	United States	2011	R	PLF	DS	725	12	Disability	Higher disability in WC than in control group

P indicates prospective; PLF, posterolateral fusion; DS, degenerative spondylolisthesis; WC, Workers Compensation; R, retrospective; IS, isthmic spondylolisthesis; ALIF, anterior lumbar interbody fusion; LBOS, low back outcome score; VAS, visual analogue scale; NOQ, NASS Outcome Questionnaire; SF-36, Short-Form 36 Multidimensional Health Survey; RCT, randomized controlled trial; PLIF, posterior lumbar interbody fusion; ODI, Oswestry Disability Index; RMDQ, Roland Morris Disability Questionnaire; SCI, Stauffer-Coventry-Index; SF-20, Short-Form 20 Multidimensional Health Survey; FS, foraminal stenosis; CC, case control.

ACOEM 2017 Lumbar Fusion

- There are **some diagnoses** for which fusion is either **non-controversial** or less controversial. These include **unstable** vertebral fractures or where surgery is being done for **tumor, infection** (osteomyelitis and/or discitis), or other disease processes that have led to spinal motion segment instability. **Treatment of these conditions is outside the scope of these guidelines.**

ACOEM Lumbar Fusion

1. Recommendation: Lumbar Fusion for Treatment of Isthmic Spondylolisthesis **Lumbar fusion is recommended as an effective treatment for isthmic spondylolisthesis.**

Strength of Evidence **– Recommended, Evidence (C)**

2. Recommendation: Lumbar Fusion for Treatment of Degenerative Spondylolisthesis

Lumbar fusion is recommended as an effective treatment for degenerative spondylolisthesis.

Strength of Evidence **– Recommended, Evidence (C)**

3. Recommendation: Lumbar Fusion for Treatment of Radiculopathy from Disc Herniation or Chronic Low Back Pain

Lumbar fusion is not recommended as a treatment for patients with radiculopathy from disc herniation or for patients with chronic low back pain after lumbar discectomy.

Strength of Evidence **– Not Recommended, Evidence (C)**

4. Recommendation: Spinal Fusion with Third Discectomy

Spinal fusion is an option at the time of discectomy if a patient is having the third lumbar discectomy on the same disc.

Strength of Evidence **– Recommended, Insufficient Evidence (I)**

5. Recommendation: Spinal Fusion for Treatment of Spinal Stenosis without Concomitant Instability or Deformity

Lumbar fusion is not recommended for treatment of spinal stenosis unless concomitant instability or deformity has been proven.

Strength of Evidence **– Not Recommended, Evidence (C)**

Page 640 ACOEM

ODG 12/28/17

(A) ***Recommended*** **as an option** for the following conditions with ongoing symptoms, corroborating physical findings and imaging, and after failure of non-operative treatment (unless contraindicated, e.g., acute traumatic unstable fracture, dislocation, spinal cord injury) subject to criteria below:

(1) **Spondylolisthesis** (isthmic or degenerative) with at least one of these:

(a) instability, and/or

(b) symptomatic radiculopathy, and/or

(c) symptomatic spinal stenosis;

(2) Disc herniation with symptomatic radiculopathy **during third** decompression at the same level;

(3) Revision of pseudoarthrosis (single revision attempt);

(4) Unstable fracture;

(5) Dislocation;

(6) Acute spinal cord injury (SCI) with post-traumatic instability;

(7) Spinal infections with resultant instability;

(8) **Scoliosis with progressive** pain, cardiopulmonary or neurologic symptoms, and structural deformity;

(9) Scheuermann's kyphosis;

(10) Tumors.

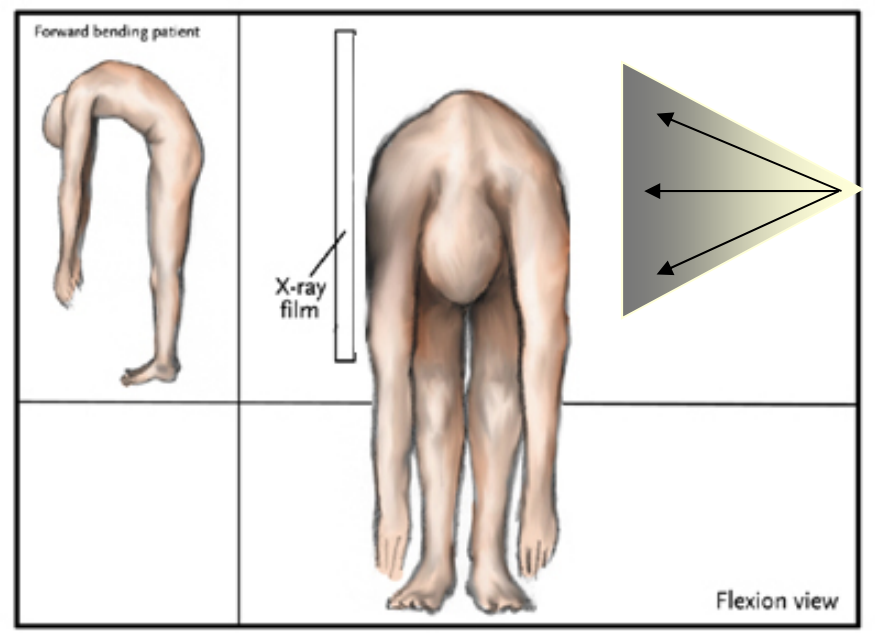
ODG 12/28/17
Lumbar Fusion

- **Not recommended in workers' compensation patients for**
  - **degenerative disc disease (DDD),**
  - disc herniation,
  - spinal stenosis **without** degenerative spondylolisthesis or **instability**, or
  - **nonspecific low back pain**,
  - **due to lack of evidence or risk exceeding benefit.**

ODG 12/28/17

- (C) *Instability criteria:* Segmental Instability (objectively demonstrable) - Excessive motion, as in isthmic or degenerative spondylolisthesis, surgically induced segmental instability and mechanical intervertebral collapse of the motion segment and advanced degenerative changes after surgical discectomy, ***with*** relative **angular motion** greater than 15 degrees L1-2 through L3-4, 20 degrees L4-5, 25 degrees L5-S1. Spinal instability criteria include lumbar inter-segmental **translational movement** of more than 4.5 mm.

Special X-ray Views: Flexion and Extension



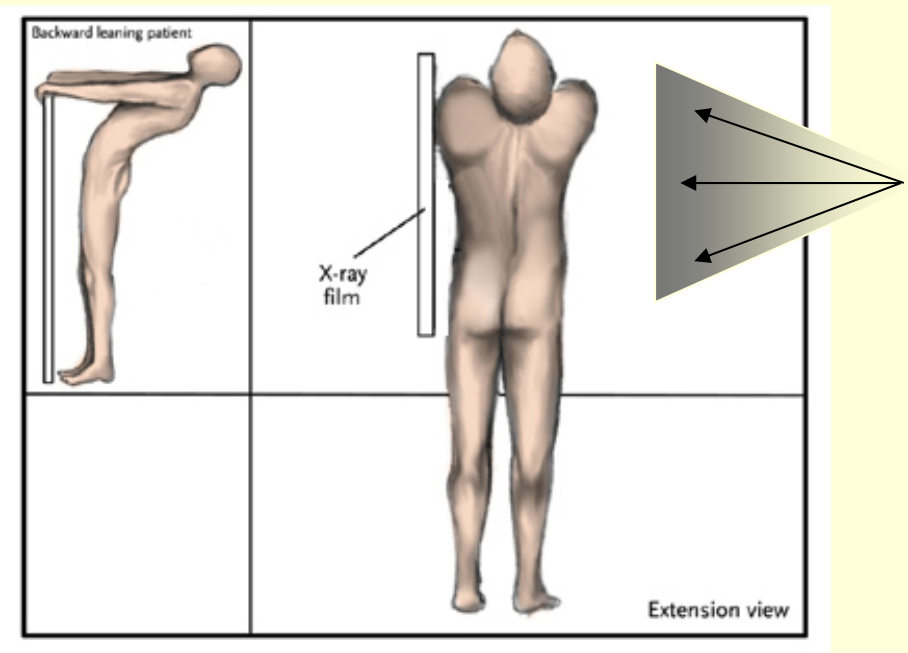


Figure 63

(4th ed., 98)

Loss of Motion Segment Integrity: Angular Motion

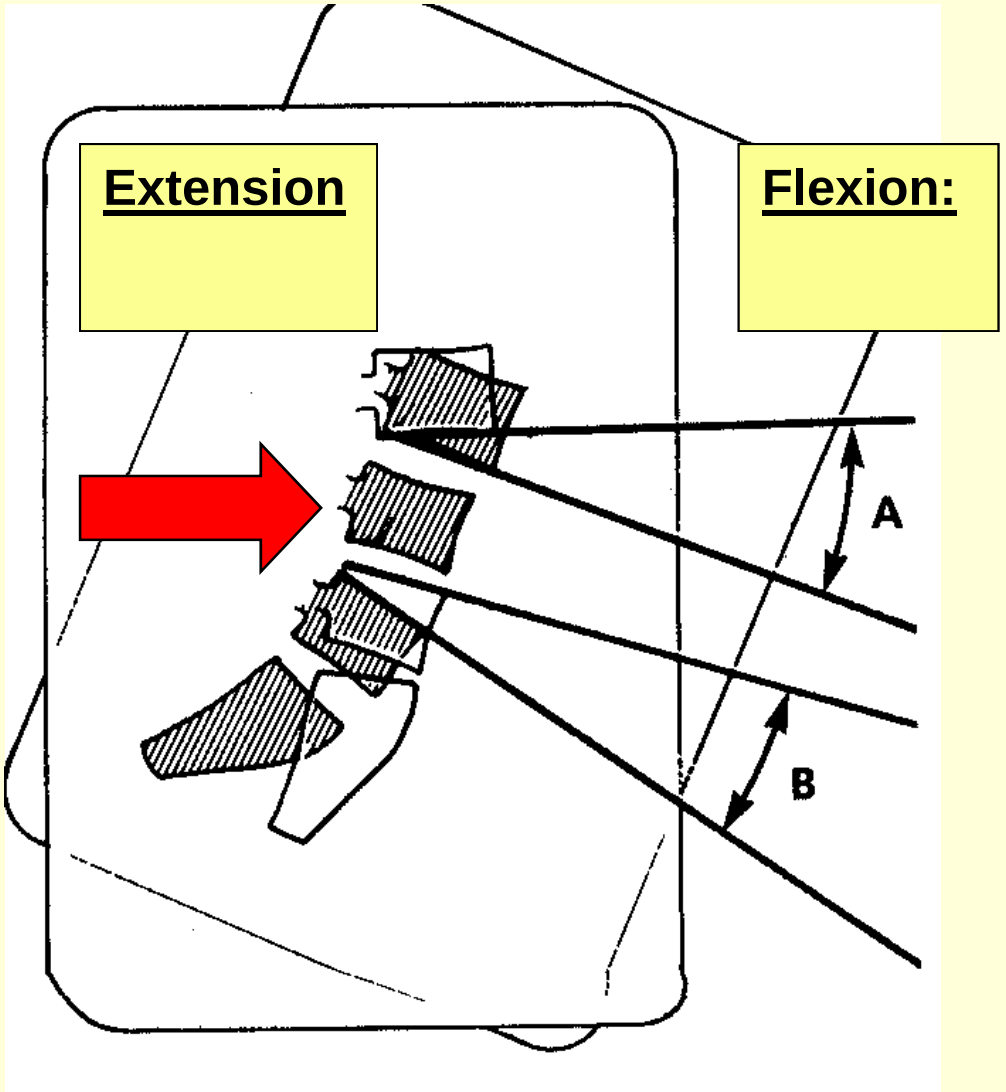
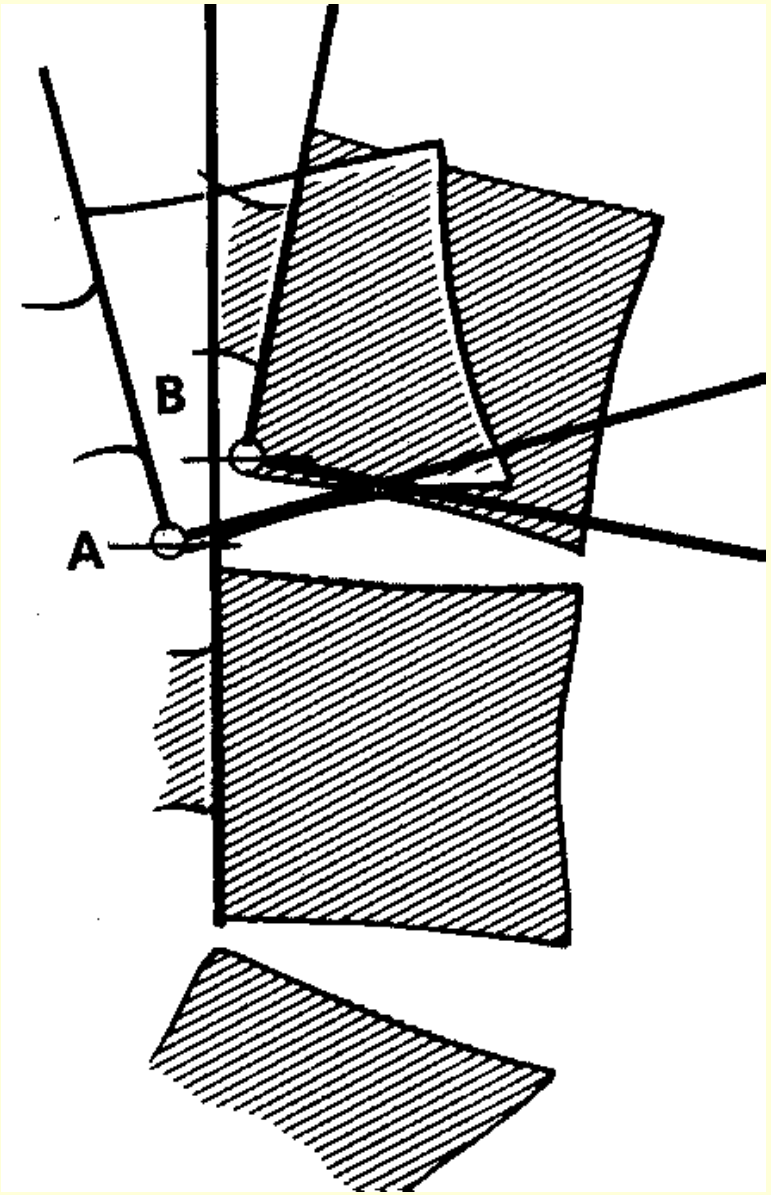


Figure 62

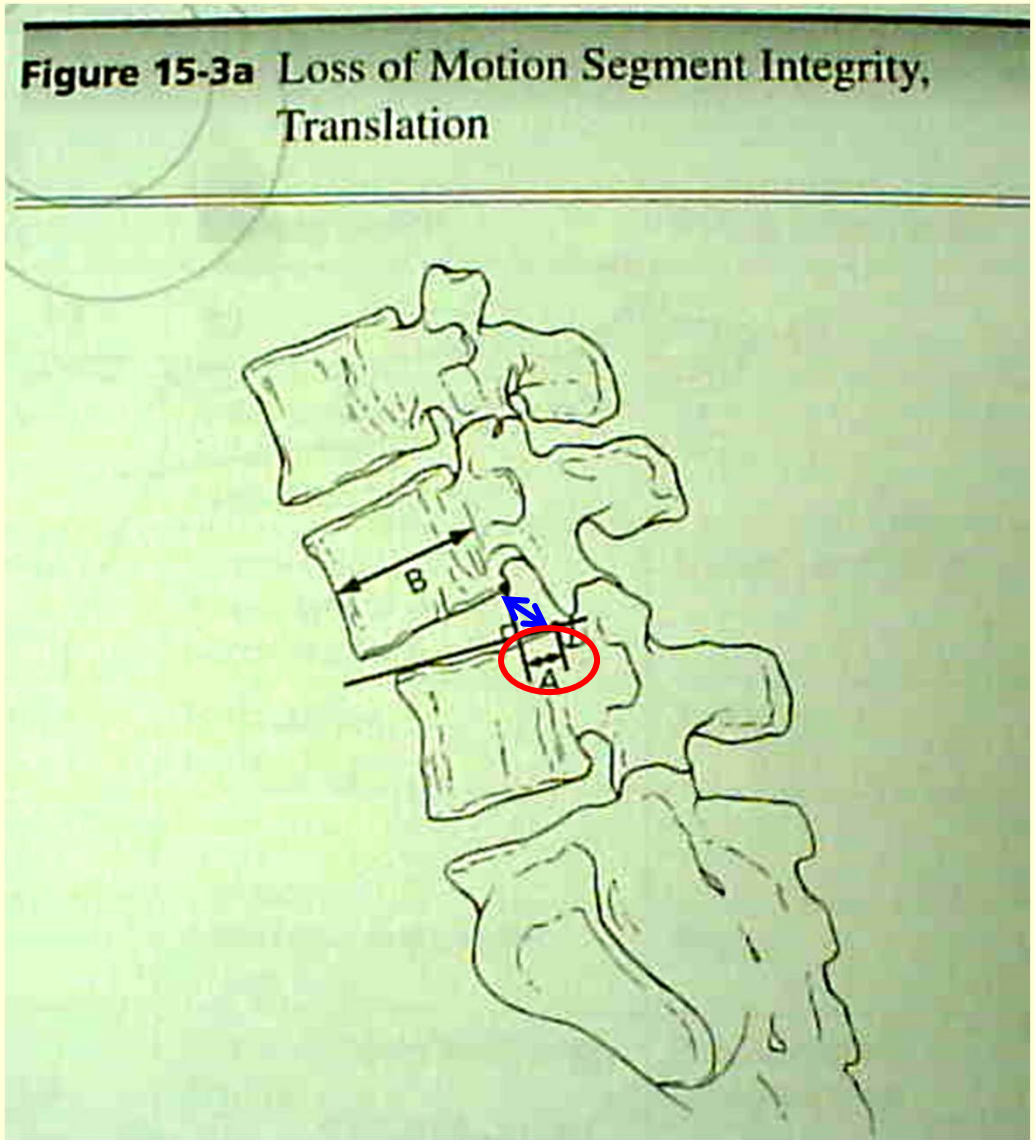
(4th ed., 98)

Loss of Motion Segment Integrity: Translation



5th Edition:

Figure 15-3a: Translation



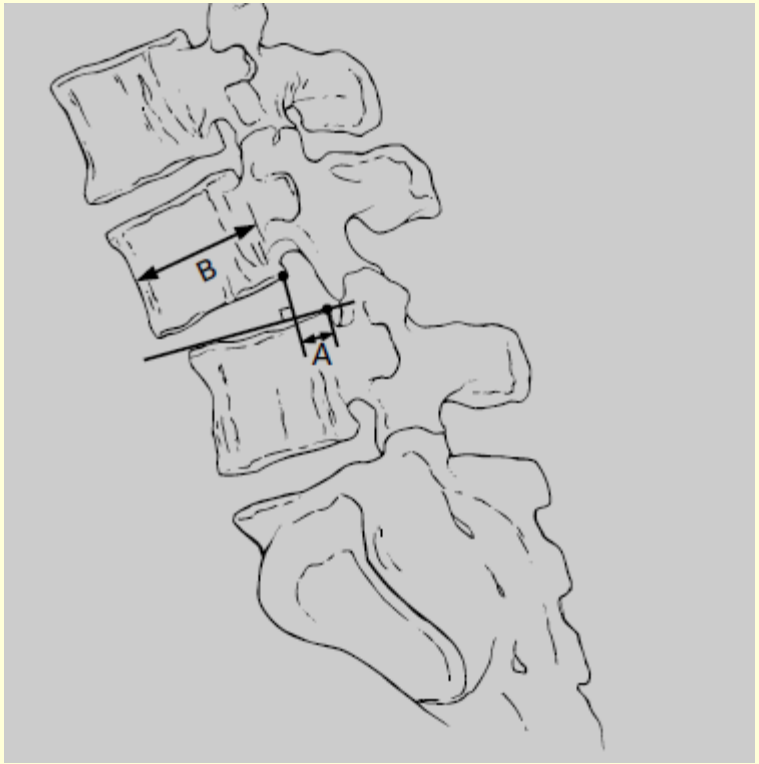
<u>New</u> Criterion is > 4.5 mm of Translation

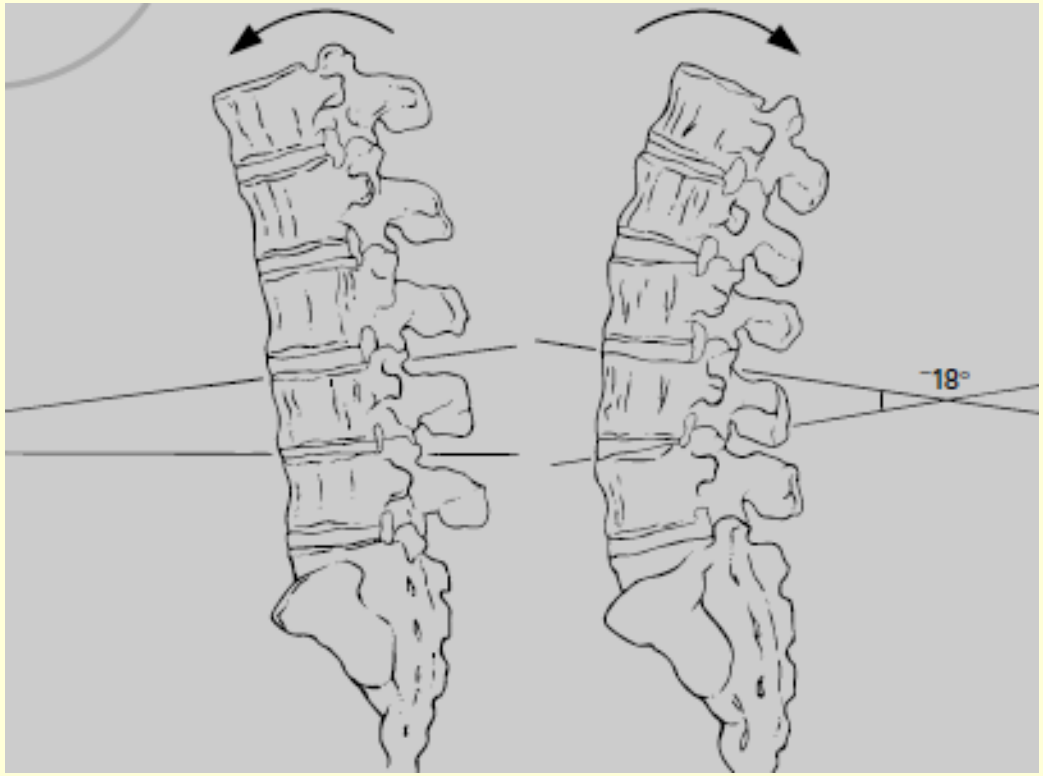
"Motion of one Vertebra over Another." **p. 379**

Measured on a Single film, not sum of measurements on 2 films.

Spinal Instability

- Consensus Defined Concept
- Some Variation in # of mm or # of degrees by different authors





Surgical Guideline for Lumbar Fusion (Arthrodesis)

Updated March 7, 2016

Effective March 7, 2016, lumbar fusion for uncomplicated degenerative disk disease (UDDD) is **not** a covered procedure; this is based on the Health Technology Clinical Committee (HTCC) determination. UDDD is defined as chronic low back pain of discogenic origin **without any evidence of** the following conditions:

- Radiculopathy,
- Functional neurologic deficits,
- Spondylolisthesis (greater than grade 1)
- Isthmic spondylolysis,
- Primary neurogenic claudication associated with stenosis,
- Fracture, tumor, infection, inflammatory disease,
- Degenerative disease associated with significant deformity

Washington State WC

- **No Prior** Lumbar Surgery:
  - Only 1 level fusion
  - **MUST have EITHER Instability or ≥ Grade 2 spondylolisthesis** with **Objective Radiculopathy** or **Instability**
- Prior Discectomy or Decompression:
  - Instability
  - Listhesis or Deformity (**progressive** and measurable)
  - Post-Op Imaging shows 100% facetectomy or bilateral 50% facetectomy

Washington State WC

- **Prior Fusion:**
  - Pseudarthrosis (objective on thin slice CT)
  - Radiculopathy or Neurogenic Claudication by Imaging AND Physical Exam
  - Note: Adjacent Level Disease Fusion Request Analyzed by "NO Prior Surgery" fusion criteria.

Washington State WC

Relative Contra-Indications for Fusion

1. Severe physical de-conditioning
2. Current smoking[1,2]
3. Multiple level degenerative disease of the lumbar spine
4. **Greater than 12 months of disability** (e.g. time-loss compensation benefits) prior to consideration of fusion
5. **No evidence of functional recovery** (e.g. return to work) for at least six months following the most recent spine surgery

Washington State WC

Relative Contra-Indications for Fusion

6. Psychosocial factors that are correlated with poor outcome, such as:

   a. History of drug or alcohol abuse

   b. High degrees of somatization on clinical or psychological evaluation

   c. **Presence of** a **personality disorder** or **major psychiatric illness**

   d. Current evidence of **factitious disorder**

Washington WC Published Outcomes – On L&I Web Site

1. The chance of an injured worker no longer being disabled 2 years after lumbar fusion is 32%.
2. **More than 50%** of workers who received lumbar fusion through the Washington workers' compensation program felt that both **pain and functional recovery were no better or were worse** after lumbar fusion.
3. The overall rate of **re-operation** within 2 years for all fusions is approximately **23%.**
4. **Smoking** at the time of fusion greatly increases the risk of pseudarthrosis[1,2].
5. Pain relief, even when present, is not likely to be complete

Washington WC Published Outcomes – On L&I Web Site

- The cause of death, accounting for **21% of all deaths** and 31% of all potential life lost, was most often associated with prescription drugs given for pain relief. **Opioid** analgesics were associated with **91%** of these deaths.
- **All** analgesic-related deaths occurred among workers who had either intervertebral **cage** devices or (pedicle screw) **instrumentation.**
- **Degenerative disc disease** is associated with an increased **risk of analgesic-related death** (rate ratio, **2.71**) especially among workers aged between 45-54 years (rate ratio, 7.45).

Washington State WC References

3. Franklin GM, Haug J, Heyer NJ, McKeefrey SP, Picciano JF. Outcome of lumbar fusion in Washington State workers' compensation. ***Spine*** 1994; 19(17): 1897-1904.

4. Juratli SM, Franklin GM, Mirza SK, Wickizer TM, Fulton-Kehoe D. Lumbar fusion outcomes in Washington State workers' compensation. ***Spine*** 2006; 31(23): 2715-2723.

5. Juratli SM, Mirza SK, Fulton-Kehoe D,Wickizer TM, Franklin GM. Mortality after lumbar fusion surgery. ***Spine*** 2009; 34(7): 740-747.

6. ~~http://www.hta.hca.wa.gov/lumbar.html~~, Accessed 10/14/2009

https://www.hca.wa.gov/assets/program/lumbar_fusion-rr_final_findings_decision_012016[1].pdf

NOT a Covered Benefit for L&I, Public Employees Health Plan, Medicaid

http://www.mtguidelines.com/MedproChapters/MT/Low%20Back%20Pain/MT%20LB%20FINAL.pdf

Low Back Pain

Montana Utilization and Treatment Guidelines

Effective July 1, 2015

Presented by:
State of Montana

Department of Labor and Industry
EMPLOYMENT RELATIONS DIVISION

G.4 Spinal Fusion (Usually Combined with Decompression)

There is some evidence that provocative **discography, facet joint blocks,** and temporary external transpedicular fixation **do not** adequately **screen patients**

http://www.mtguidelines.com/MedproChapters/MT/Low%20Back%20Pain/MT%20LB%20FINAL.pdf

Indications for spinal fusion may include:

1. Neural arch defect usually with stenosis or **instability** – Spondylolytic spondylolisthesis, congenital unilateral neural arch hypoplasia. It should be noted that the highest level of success for spinal fusions is when spondylolisthesis **grade 2 or higher** is present.

2. Segmental **Instability** - Excessive motion, as in degenerative spondylolisthesis 4mm or greater, surgically induced segmental instability.

http://www.mtguidelines.com/MedproChapters/MT/Low%20Back%20Pain/MT%20LB%20FINAL.pdf

3. Primary **Mechanical Back Pain**/Functional Spinal Unit Failure - Multiple pain generators objectively involving **two or more** of the following:

(a) internal disc disruption
(poor success rate if more than one disc involved),

(b) painful motion segment, as in annular tears,

(c) disc resorption,

(d) facet syndrome, and/or

(e) ligamentous tear.

Because surgical outcomes are **less successful** when there is neither stenosis nor instability, the requirements for pre-operative indications must be strictly adhered to for this category of patients.

http://www.mtguidelines.com/MedproChapters/MT/Low%20Back%20Pain/MT%20LB%20FINAL.pdf

4. Revision surgery for failed previous operation(s) if significant functional gains are anticipated.

5. Other diagnoses: Infection, tumor, or deformity of the lumbosacral spine that cause intractable pain, neurological deficit, and/or functional disability.

6. For any potential fusion surgery, it is recommended that the injured worker **refrain from smoking for at least six weeks prior** to surgery and during the period of fusion healing. Because smokers have a higher risk of non-union and higher post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively.

http://www.mtguidelines.com/MedproChapters/MT/Low%20Back%20Pain/MT%20LB%20FINAL.pdf

Pre-operative Surgical Indications: Required pre-operative clinical surgical indications for spinal fusion include **all** of the following:

1. All pain generators are adequately defined and treated; **and**

2. All physical medicine and manual therapy interventions are completed; **and**

3. X-ray, MRI, or CT myelography demonstrate spinal stenosis with instability or disc pathology, requiring decompression that may surgically induce segmental instability or a positive discogram; **and**

Pre-Operative Indications (Continued)

4. Spine pathology is limited to two levels; and

5. Psychosocial evaluation with confounding issues addressed; (required for all cases except those with degenerative spondylolisthesis with persistent claudication or radicular leg pain with neurologic signs); and

6. For any potential fusion surgery, it is recommended that the **injured worker refrain from smoking for at least six weeks** prior to surgery and during the period of fusion healing.

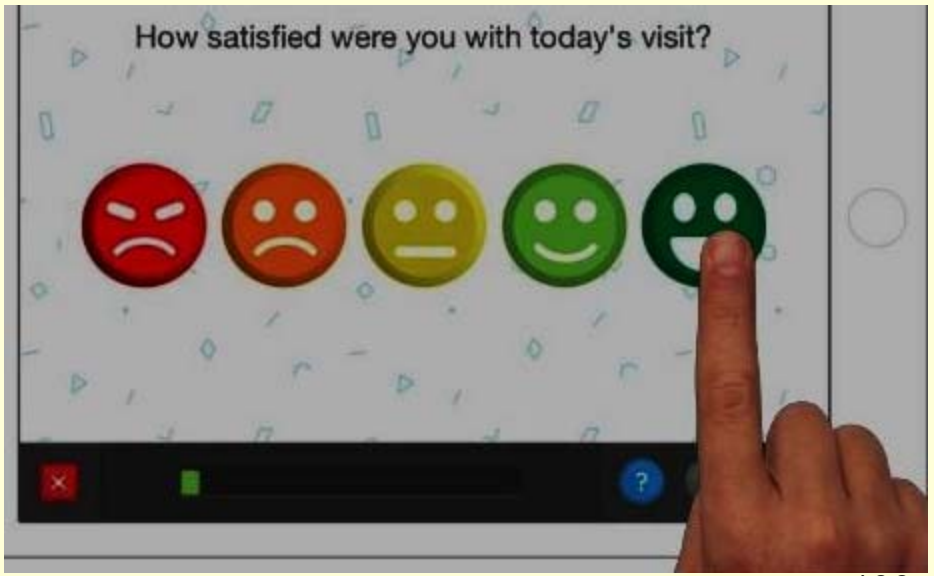
Utah Workers' Compensation

- Cuneo JG, et al. Lumbar Fusion in Utah Workers' Compensation. **Spine** 2016; 42 (9): 692-9.
- All Fusions in WC 1998-2007 cohort **compared to** 1990-1995 cohort**.**
- Despite **increased solid fusion rates**, injured workers who have undergone lumbar fusion in Utah demonstrated **equivalent and in some cases worse outcomes** than those documented a decade ago.
  - SF-36, Roland Morris, Stauffer-Coventry Index
- Specifically, there were significant **increases in back pain dysfunction and narcotic medication usage** in the current versus the past cohort.
- Medical and compensation **costs** for compensated lumbar fusion also significantly **increased**

Questionnaires Are Subjective

"After Surgery, Are You BETTER?"

- May Correlate in Several Populations
- But May Correlate Better with How Well the Patient LIKES the Doctor – NOT the Outcome



Assessing Outcome: Problem of Recall

- Aleem IS, et al.

Spine 2017; 42: 128-134

- Mayo Clinic **Spine Surgery** Patients
- **Recall Bias** Affects Assessment by
- Patient stated **"Improvement"**

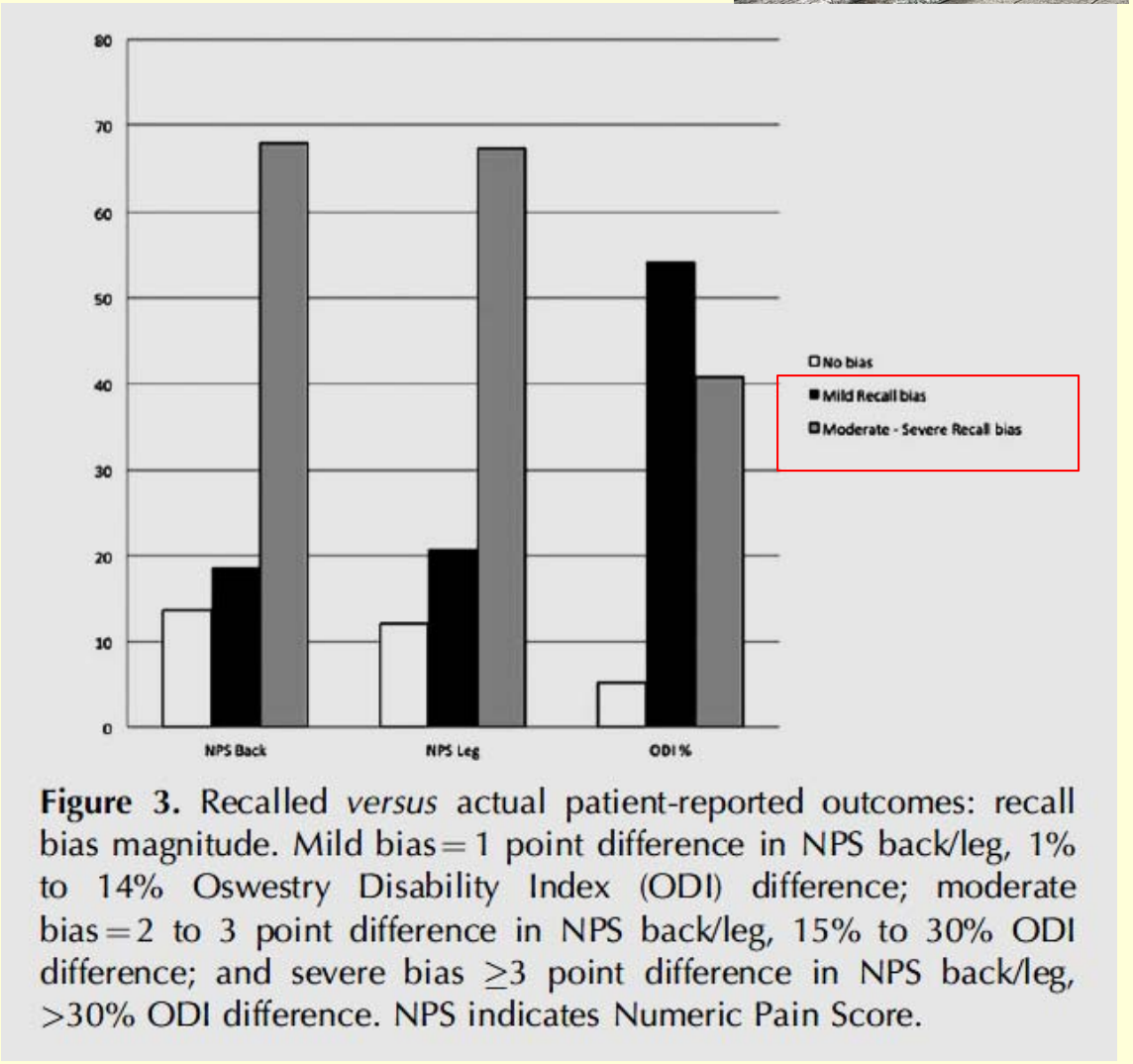


Figure 3. Recalled *versus* actual patient-reported outcomes: recall bias magnitude. Mild bias = 1 point difference in NPS back/leg, 1% to 14% Oswestry Disability Index (ODI) difference; moderate bias = 2 to 3 point difference in NPS back/leg, 15% to 30% ODI difference; and severe bias ≥3 point difference in NPS back/leg, >30% ODI difference. NPS indicates Numeric Pain Score.

Deyo et al. *Pain* Mar 6, 2018
Spine Mar 15, 2018

- Oregon data base
  - All 2491 lumbar fusions for degenerative disease, NOT just WC
- 1045 on long-term Opioids BEFORE fusion [42%]
- **1094** on long-term Opioids **AFTER** fusion
- Of those 1045 on long-term Opioids **BEFORE** fusion
  - 9.1% discontinued Opioids, or were short term Opioid users AFTER
  - **77.1% continued** long-term Opioids
    - 34.4% received a lower Opioid dose
    - **44.8% received a HIGHER Opioid dose**
- Of those **NOT using Opioids BEFORE** fusion,
  12.8% became long-term Opioid users AFTER fusion.

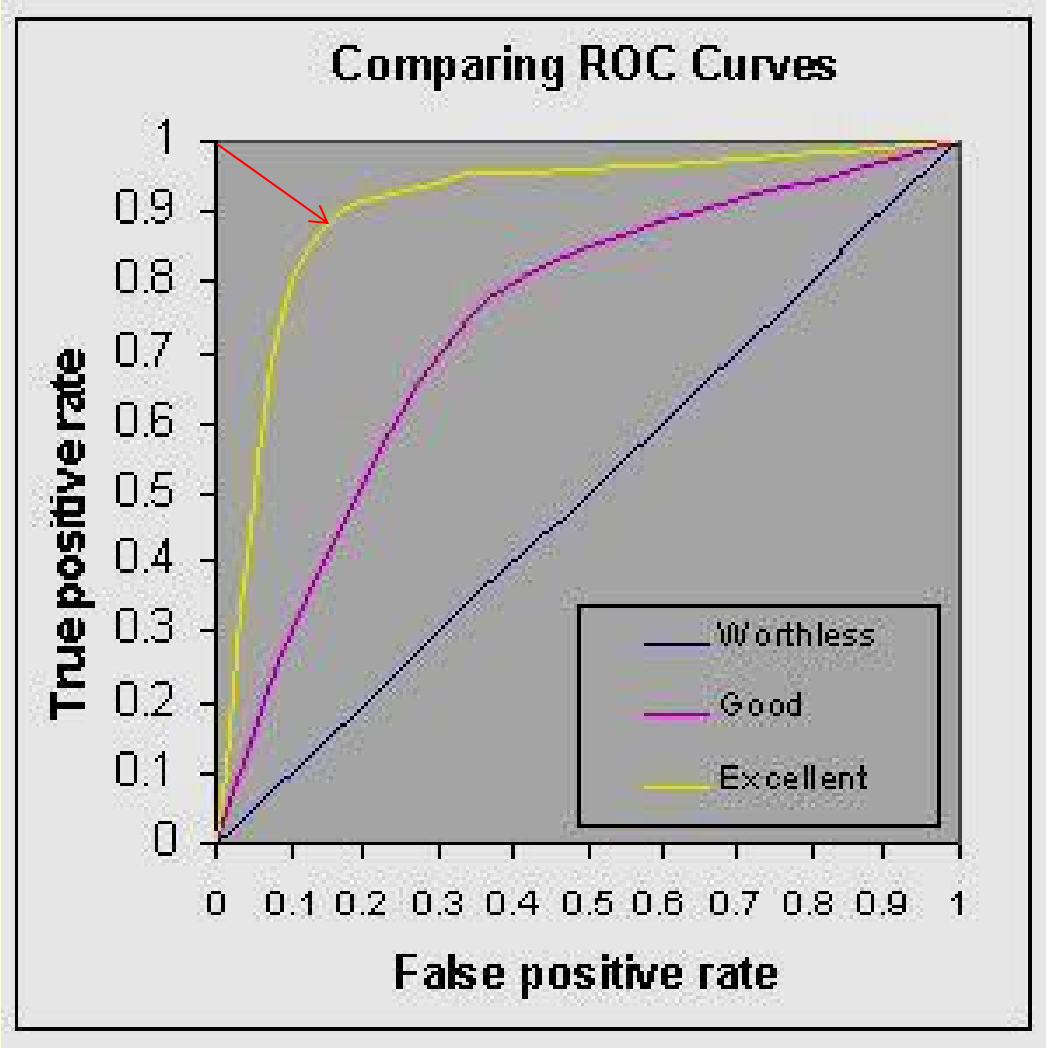
Measuring Improvement After Surgery

- MCID: Minimal Clinically Important Difference
  - Smallest change that is important to patients
  - Most often anchor based
- SCB: Substantial Clinical Benefit
  - Better reflects goal [intended benefit] of intervention

- Park KB, et a. Spine 2017; 42 (8): E474 - E481
- MCID: ROC to determine Cut Point between "no change" and "somewhat improved"
- SCB: ROC to determine Cut Point between "somewhat improved" and "much improved"
- Minimal Detectable Change (MDC) minimum change to confidently state difference is real, and not measurement error

Examples of ROC Curves

- Receiver Operating Characteristic Curves
- Cut Point is the point nearest the upper left hand corner of the graph.



True Positive (Sensitivity) vs. False Positive (1-specificity)

Spine 2017; 42 (8): E474 - E481

Outcome Metric*	MDC	MCID	SCB
LBP – VAS	12.00	22.50	32.50
LEG PAIN – VAS	16.36	27.50	37.00
ODI	10.43	9.00	15.00
SF-36 PCS	9.76	10.23	19.73
SF-36 MCS	14.46	4.00	21.13

*** = Improvement with Spine Surgery from Pre-Op to Post-OP**

There are stricter definitions for spine surgery,
such as van Hoff ML, et al. *The Spine Journal* 2016; 16: 1221-30.
Patient Acceptable Symptom State = Oswestry Outcome ≤ 22
Carragee EJ. *The Spine Journal* 2010; 10: 313-20
Minimum Acceptable Improvement VAS = 30, ODI = 20

Posterolateral Fusion in **KY WC**

- Carreon LY, et al. Spine 2010; 35 (19): 1812-7
  - 783 patients, 1 spine center – Louisville
- After controlling for covariates known to affect outcomes after lumbar fusion, patients on **workers' compensation have significantly less improvement** of clinical outcomes in both mean change in ODI and SF-36 PCS, as well as the number of patients achieving substantial clinical benefit.

Posterolateral Fusion in KY WC

Spine 2010; 35 (19): 1812-7

Table 3. Proportion of Patients Achieving Minimum Clinically Important Difference and Substantial Clinical Benefit Thresholds for the Different Outcome Measures

	Nonworkers' Compensation	Workers' Compensation	Unmatched Cohort
Minimum clinically important difference thresholds			
ODI ≥12.8	21 (36%)	11 (19%)	342 (51%)
PCS ≥4.9	23 (40%)	9 (16%)	326 (49%)
BP ≥1	43 (74%)	31 (53%)	516 (78%)
LP ≥2	27 (47%)	16 (28%)	379 (57%)
Substantial clinical benefit thresholds			
ODI ≥18.8	19 (33%)	5 (9%)	252 (38%)
PCS ≥6.2	21 (36%)	7 (12%)	294 (44%)
BP ≥3	24 (41%)	13 (22%)	308 (46%)
LP ≥3	22 (38%)	10 (17%)	292 (44%)

ODI indicates oswestry disability index; PCS, physical component summary; BP, back pain; LP, leg pain.

Park KB, et a.
Spine 2017;42(8): E474 - E481

Outcome Metric*	MDC	MCID
ODI	10.43	9.00
SF-36 PCS	9.76	10.23
LBP – VAS	12.00	22.50
LEG PAIN – VAS	16.36	27.50

Outcome Metric*	SCB
ODI	15.00
SF-36 PCS	19.73
LBP – VAS	32.50
LEG PAIN – VAS	37.00

Old Joke

When you're about to HIRE an Accountant

To Do YOUR Taxes, Ask,

"How Much is 2 + 2?"

Hire the Accountant who answers

"How much do you want it to be?"

Waldorf and Statler –from the Muppet Show

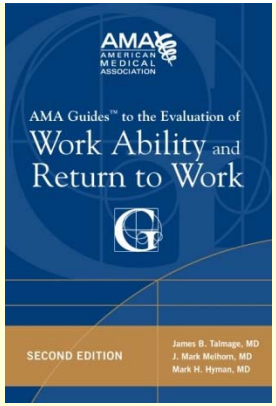
FCE Outcomes: Spinal Disorders

"I Feel Comfortable Doing . . ."

- Bohl DD, et al. FCE after Spine Fusion - Spine 2016; 41 (13): 1104-10
- RUSH University, Chicago

	TLIF (N = 71)	
	Number	Percentage
FCE-determined work capability		
Sedentary/light	41	58%
Medium	18	25%
Heavy/very heavy	12	17%
FCE-determined meeting of job requirement		
No	45	63%
Yes	26	37%

Analysis: After Lumbar Fusion



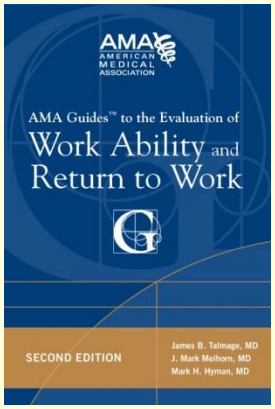
- **Risk**: None short term
  - Long Term Adjacent Segment "Disease" is debated and debatable. [**NOT** an ADA "reason"]
  - Radicular neurologic deficit can be followed with serial physical exam after RTW.
  - Opioids may pose a risk for safety sensitive work
    - JOEM 2014; 56 (7): e46-e53
- **Capacity:**
  - Progressively fading activity guidelines leading to clearance for Sedentary, Light, and **Moderate work** is VERY REASONABLE

RTW in **NON**-WC Patients After Spine Surgery

- Lee YP, et al. JAAOS 2017; 25: e282-e288
- Two California University Spine Centers
- Primarily Fusions in Primarily Older Adults
- 130 of 326 patients worked before surgery
  - 111 or **85% RTW** after surgery
- 44 patients were **not working** and were **not already** retired or declared "disabled"
  - 1 of 44 or **2% RTW** after surgery
  - Odds Ratio = 299. for RTW if working before

After Lumbar Fusion

- **TOLERANCE:**
  - **THE issue** that limits FCE performance or willingness to work despite symptoms.
  - **NOT** a basis for Physician IMPOSED activity **Restrictions** **or** Physician described activity **Limitations.**



Fusion: WC Back Pain
[DDD, Black Disc, Discogram +]

- **725 lumbar fusion cases** were compared to **725 MATCHED controls** who were randomly selected from a pool of Ohio **Workers' Compensation** subjects with chronic low back pain

Spine

SPINE Volume 36, Number 4, pp 320–331
©2011, Lippincott Williams & Wilkins

EPIDEMIOLOGY

Long-term Outcomes of Lumbar Fusion Among Workers' Compensation Subjects

A Historical Cohort Study

Trang H. Nguyen, MD, PhD,* David C. Randolph, MD, MPH,* James Talmage, MD,† Paul Succop, PhD,* and Russell Travis, MD‡

Spine 2011; 36 (4); 320-331

TABLE 4. Return to Work, Rehabilitation, Disabled, and Death Status

	Cases	Controls	*P*
Death*—no. (%)	17 (2.34%)	11 (1.52%)	0.26
Permanently disabled →	82 (11.31%)	11 (1.52%)	<0.001
In rehabilitation†	64 (8.83%)	43 (5.93%)	0.04
Returned to work			
No	367 (50.62%)	163 (22.48%)	<0.001
Yes →	188 (25.93%)	483 (66.62%)	<0.001
No information	7 (0.97%)	14 (1.93%)	0.12
Total	725	725	

Spine 2011; 36 (4); 320-331

- Workers' compensation subjects with lumbar arthrodesis had a **poor RTW** status 2 years after surgery, higher disability status, and a larger number of subjects continued on daily opioids compared to nonsurgical controls.
- Significant predictors of RTW status for surgical cases were the number of days off , **legal representation**, **weekly wages**, **complications, reoperations**, and **total morphine usage.**

Spine 2011; 36 (4); 320-331

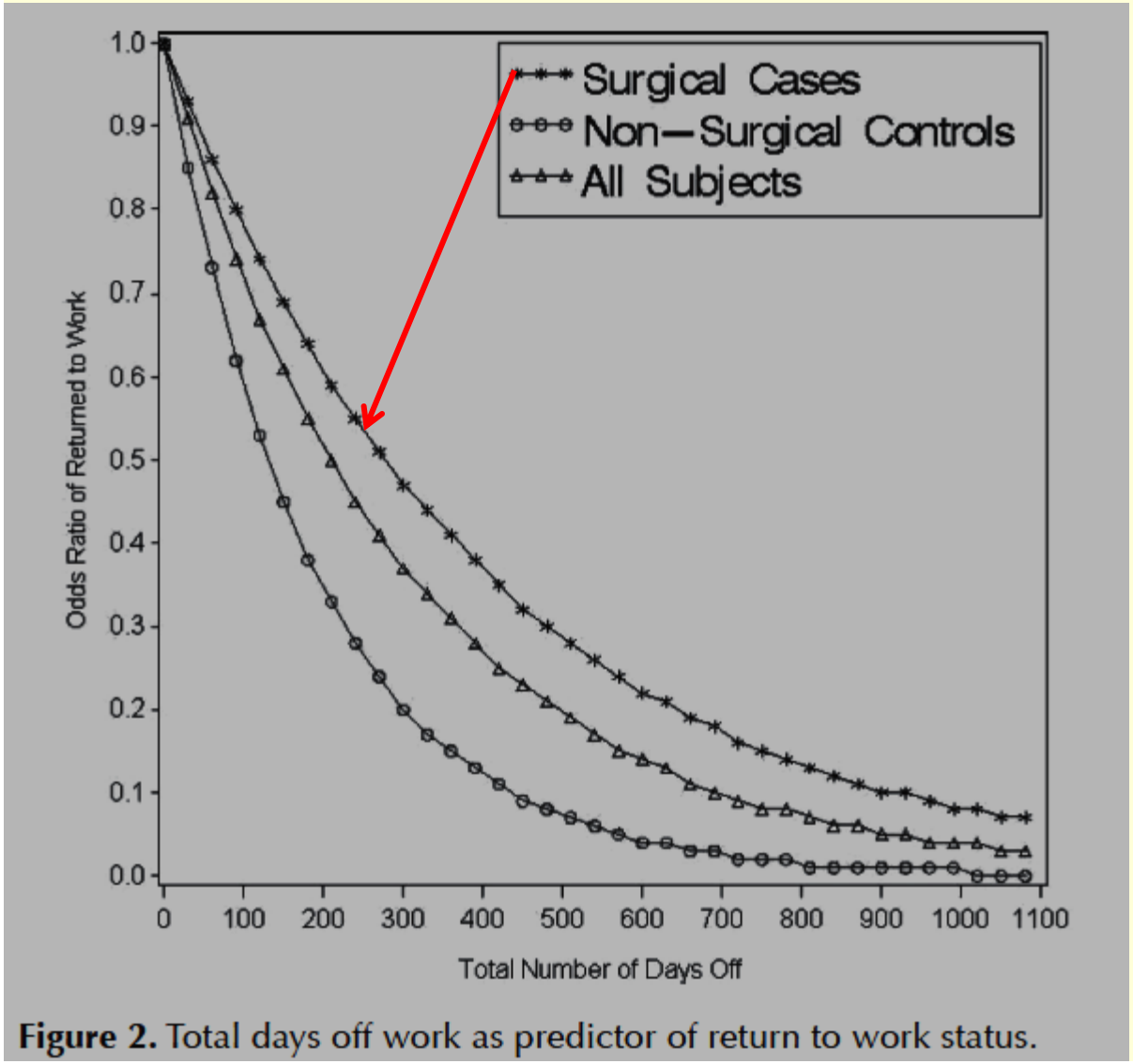


Figure 2. Total days off work as predictor of return to work status.

- Off Work a **long time**, **FUSION is UNLIKELY** to result in **RTW**,
- But so is continued treatment

Spine 2011; 36 (4); 320-331

- Surgical cases matched by age, diagnosis, time off work before surgery to a Non-surgically treated comparison subject.
- **Surgery was expected to decrease pain**, but **morphine equivalent dose INCREASED**

Daily Amount of Morphine	Cases	Nonsurgical Controls	*P*
Average daily MEQ†† (mean SD)	48.06 ± 43.88	65.57 ± 70.66	<0.001‡‡
No. subjects taking opioids§§ No. (%)	614 (84.69%)	354 (48.83%)	<0.001¶¶
Average daily MEQ before surgery	44.23 ± 33.57		
Average daily MEQ after surgery	62.31 ± 70.80		
Maximum daily MEQ		585.00	
Before surgery	276.00		
After surgery	878.00		

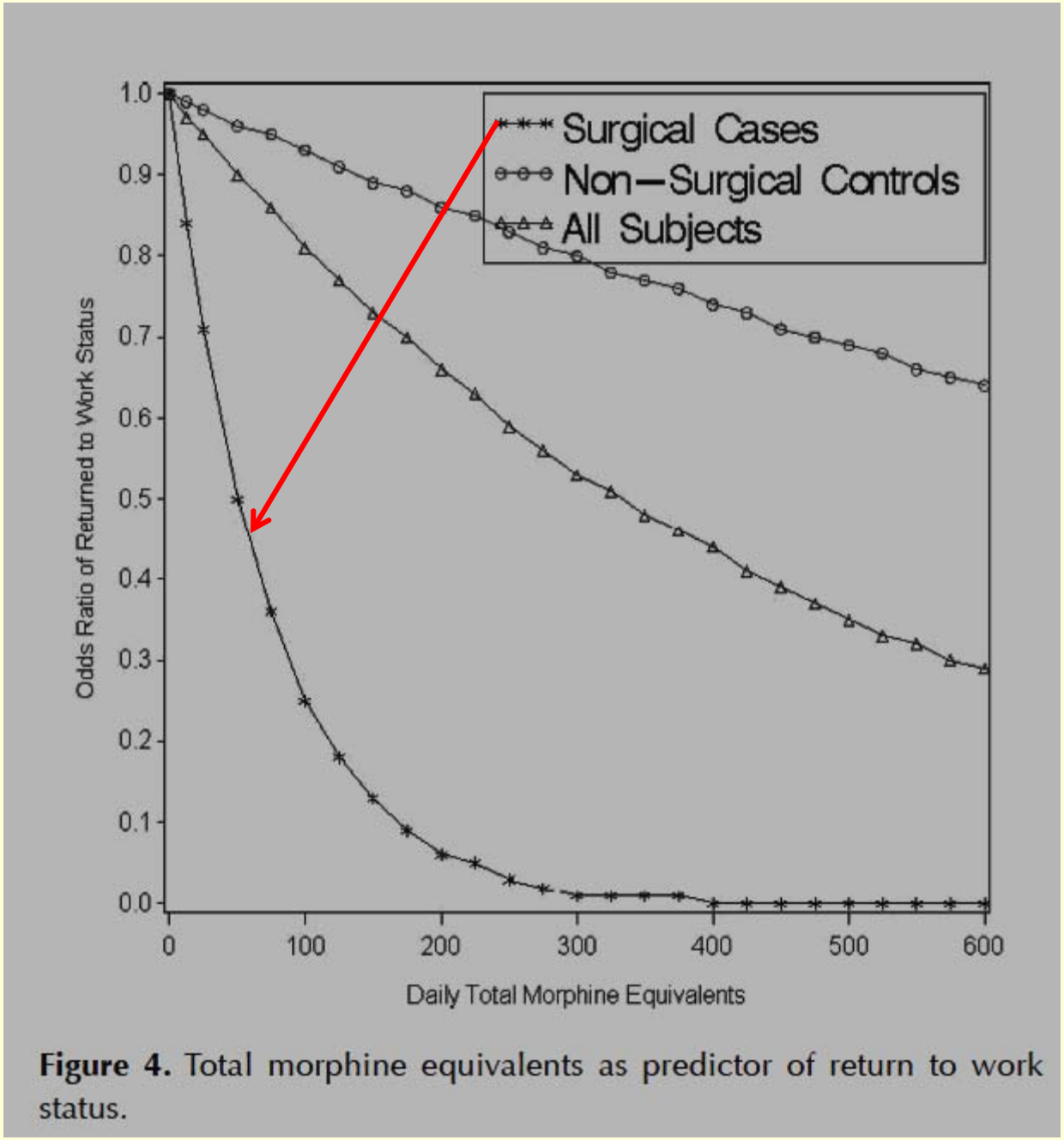


Figure 4. Total morphine equivalents as predictor of return to work status.

Ohio WC

- **Opioids predict failure** to **return to work**

TABLE 6. Univariate Logistic Regression of Return to Work Status

Independent Variables	Surgical Unadjusted OR (95% CI)	*P*
Age* (yr)	1.00 (0.98–1.02)	0.81
BMI†	0.99 (0.96–1.02)	0.42
Fusion type		0.74
Posterior uninstrumented single level fusion (reference)		
ALIF multilevel‡‡	1.41 (0.39–5.13)	0.60
ALIF single level	0.78 (0.25–2.40)	0.67
Anterior-posterior 360 multilevel	0.35 (0.08–1.50)	0.16
Anterior-posterior 360 single level	0.92 (0.25–3.39)	0.90
PLIF multilevel§§	1.24 (0.40–3.88)	0.71
PLIF single level	0.92 (0.33–2.58)	0.88
Posterior uninstrumented multilevel	0.92 (0.07–12.32)	0.95
Posterior with instrumentation multilevel	1.12 (0.37–3.40)	0.84
Posterior with instrumentation single level	0.92 (0.27–3.14)	0.89

Fusion Type Did NOT affect objective OUTCOME

Ohio WC Studies on Lumbar Fusion

Condition	Reference
RTW after Fusion	Orthopedics 2015; doi 10.3928/01477447-20151120-02
Fusion for Spondylolisthesis	Orthopedics 2015 doi 10.3928/01477447-20151218-01
Any indication	Spine 2011; 36 (4): 320-31
1 Level Fusion	Spine 2015: 40 (5): 323-31
DDD with Depression	Spine 2015; 40 (10): 748-56
DDD with Opioids	Spine 2015; 40 (22): 1775-84
Lumbar stenosis – Decompr ± Fusion	Spine 2017; 42 (13): 1017-23
Recurrent Discectomy ± Fusion	Spine 2017; 42 (14): e864-e870

Ohio Workers' Compensation

Single Level Fusion

- Compare **Known** pathologic **cause** (Spondylolisthesis) to **presumed DDD (backache) – PLF or PLIF only**
  - 3 year minimum follow up
  - **269** fusions for spondylo vs. **620** for "DDD"
- Because smoking is a known risk factor for worse outcomes, we **excluded** subjects with a positive smoking history from the initial population of 14,640 subjects.[23–26]
- Anderson JT, et al. Spine **2015**; 40 (5): 323-31

14,640 of LBP WC Claims Resulted in Either PLF or PLIF

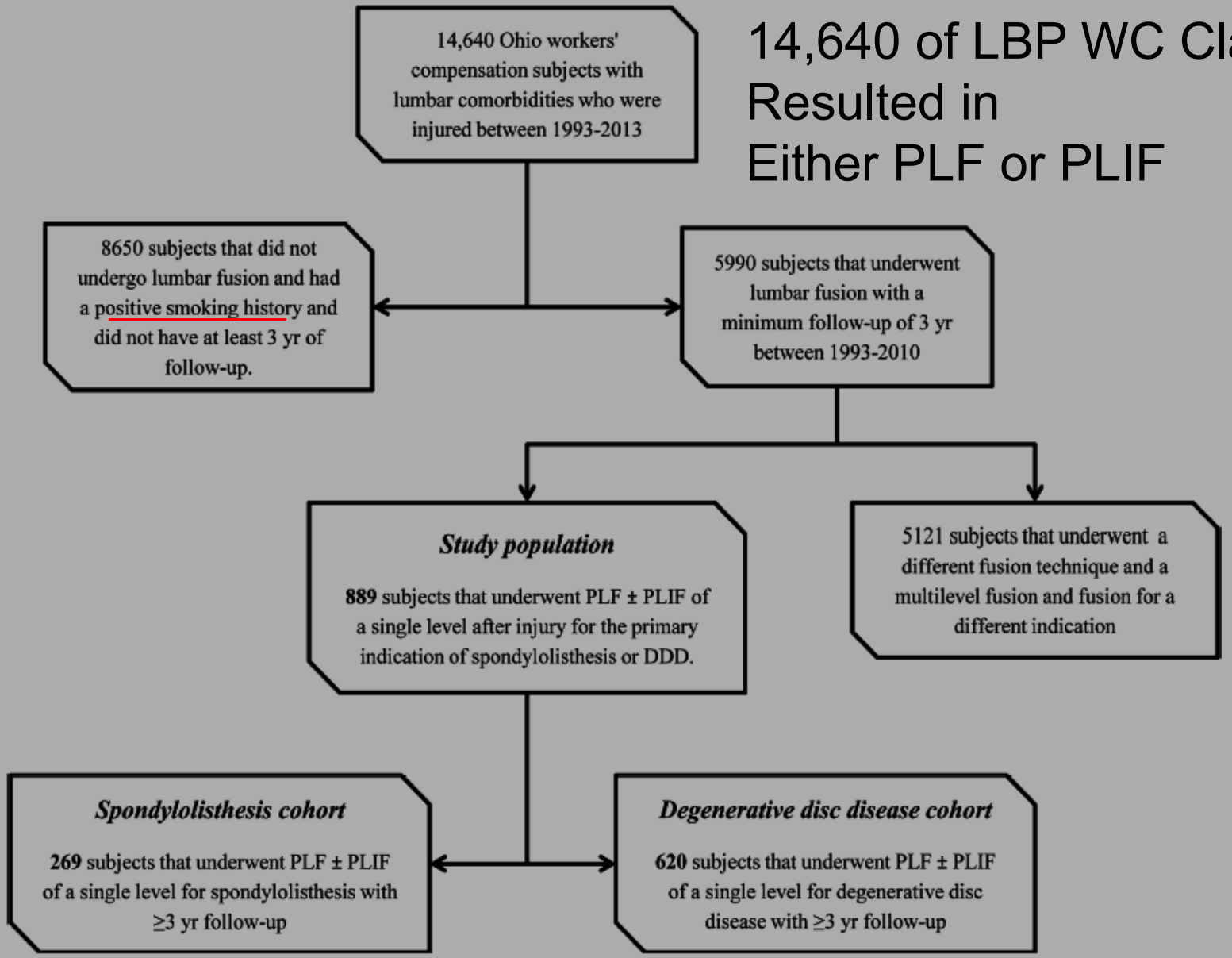


Figure 1. Subject selection flow diagram. We used a combination of *ICD-9* diagnosis and *CPT* procedural codes to arrive at our final study population. *ICD-9* indicates *International Classification of Diseases, Ninth Revision*; *CPT*, *Current Procedural Terminology*; DDD, degenerative disc disease; PLF, posterior lumbar fusion; PLIF, posterior lumbar interbody fusion.

Anderson JT, et al. Spine 2015; 40 (5): 323-31
Ohio Workers' Compensation

- **Subjects fused for spondylolisthesis**
  - returned to work in a reasonable timeline at a 12% higher rate,
  - were absent from work for an average of 164 fewer days, and [3 years after fusion]
  - were supplied with narcotic pain medication for an average of 294 fewer days postoperatively

than subjects fused for (PRESUMED) DDD

3 Year after Fusion Data
Spine 2015; 40 (5): 323-31:

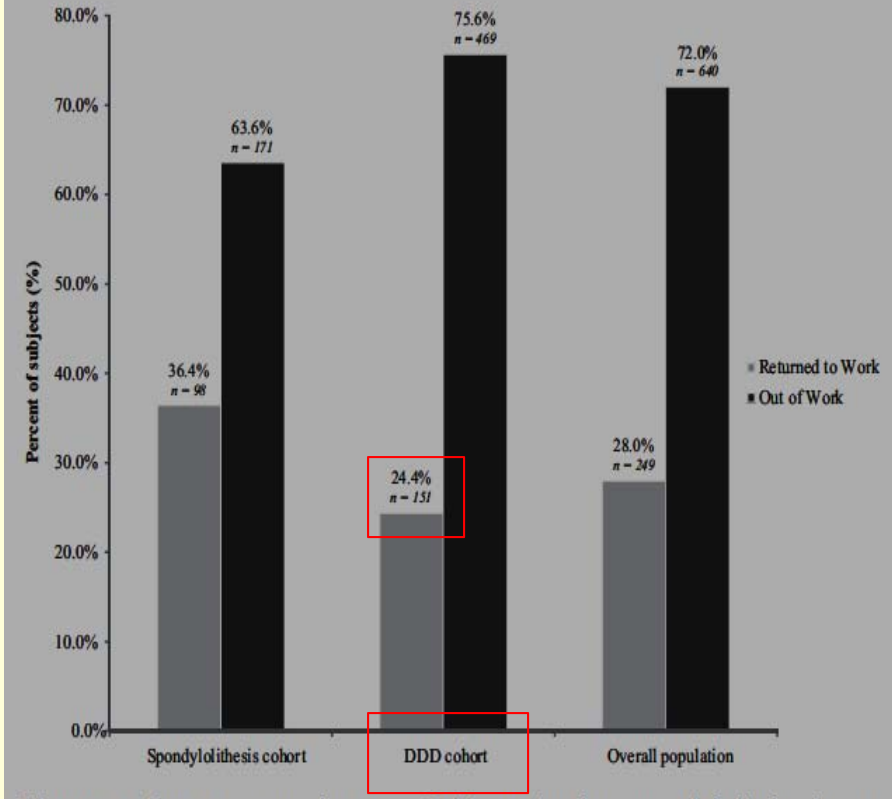
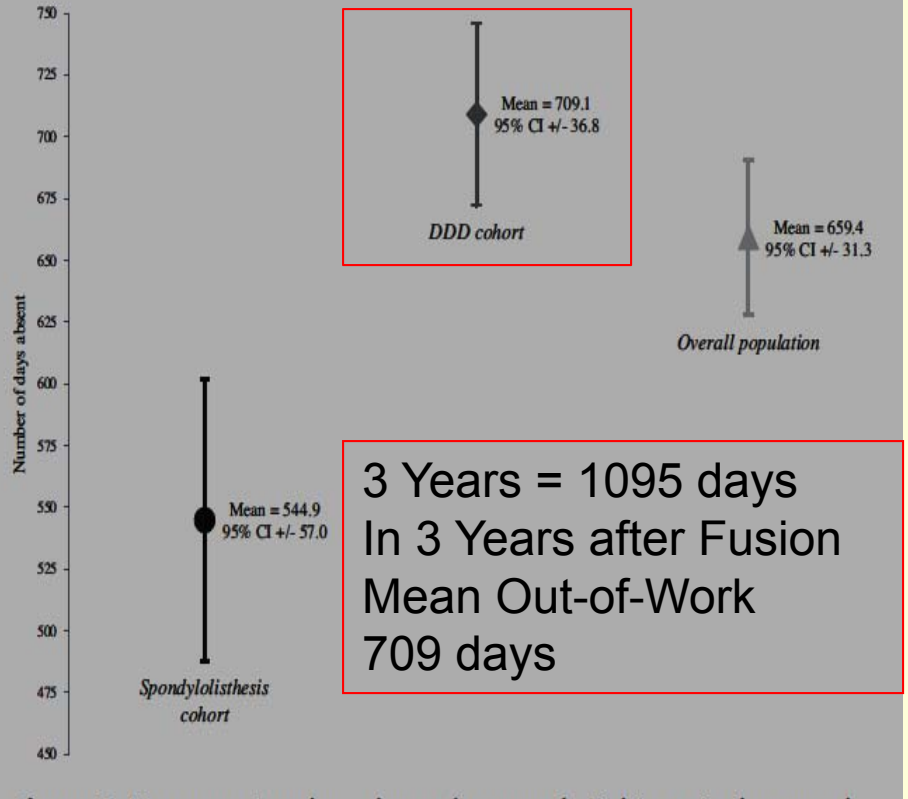


Figure 2. Return-to-work rates. Subjects in the spondylolisthesis cohort returned to work within a reasonable timeline after fusion at a significantly lower rate compared with the DDD cohort ($P = 0.050$; OR 1.41). OR indicates odds ratio; DDD, degenerative disc disease.



3 Years = 1095 days
In 3 Years after Fusion
Mean Out-of-Work
709 days

Figure 3. Postoperative days absent from work. Subjects in the spondylolisthesis cohort were absent from work for significantly fewer days at 3 years after fusion compared with the DDD cohort ($P < 0.001$). DDD indicates degenerative disc disease.

Anderson JT, et al. Spine 2015; 40 (5): 323-31
Ohio Workers' Compensation

- The DDD cohort was a much more complex subset of subjects in terms of psychosocial factors.
  - Having psychotherapy BEFORE Fusion, Odds Ratio (OR) for **RTW = 0.30** – $p<0.001$
- Also, subjects in both cohorts who were **out of work for more than 1 year** after fusion were even less likely to RTW.

Anderson JT, et al. Spine 2015; 40 (5): 323-31
Ohio Workers' Compensation

- Given such **poor outcomes** and low RTW rates seen in our study, **questions** may be raised as to whether lumbar **fusion surgery is appropriate** in similar patients with WC.
- Our study is also supportive of the conclusion that **DDD is a questionable indication for spinal fusion**.

Anderson JT, et al. Spine 2015; 40 (10): 748-56
Ohio Workers' Compensation

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

  - Same authors, different study
  - **Excluded** the patients with **MANY** pre-operative **predictors of bad results**
    - Smoking history, prior lumbar surgery, failed back surgery syndrome, and permanent disability
  - 2799 Ohio WC fusions 1993-2013 (PLF, PLIF, ALIF, 360° etc. – any approach)
  - 123 clinically diagnosed with **Depression PRE-OP**
  - 2676 **NO diagnosis** of Depression Pre-Op

Anderson JT, et al. Spine 2015; 40 (10): 748-56 Ohio Workers' Compensation

- Pre-Op Diagnosed Depression group
  - **10.6%** [13/123]) and **controls** (**33.0%** [884/2676]) met our **RTW** criteria ($P < 0.001$).
  - Pre-operative depression was a **negative predictor** of RTW status ($P < 0.001$; odds ratio [OR]: 0.38).
- Additional Return to Work predictors
  - working during same week as fusion (OR: 2.15),
  - age more than 50 years (OR: 0.58),
  - chronic preoperative opioid analgesia (OR: 0.58),
  - and legal representation (OR: 0.64).

Spine 2015; 40 (10): 748-56
Depression and WC Fusion

- **Conclusion.** Overall, RTW rates after fusion were **low**, which was **especially true** for those with pre-existing depression.
- **Depression was a strong negative predictor of postoperative RTW status.**
- Psychological screening and treatment may be beneficial in these subjects.
- The **poor outcomes** in this study may highlight a **more limited role for fusion** among WC subjects with chronic low back pain where RTW is the treatment goal.

Spine 2015; 40 (10): 748-56

- 123 ÷ 2799 = **4%** Pre-Op Dx of Depression

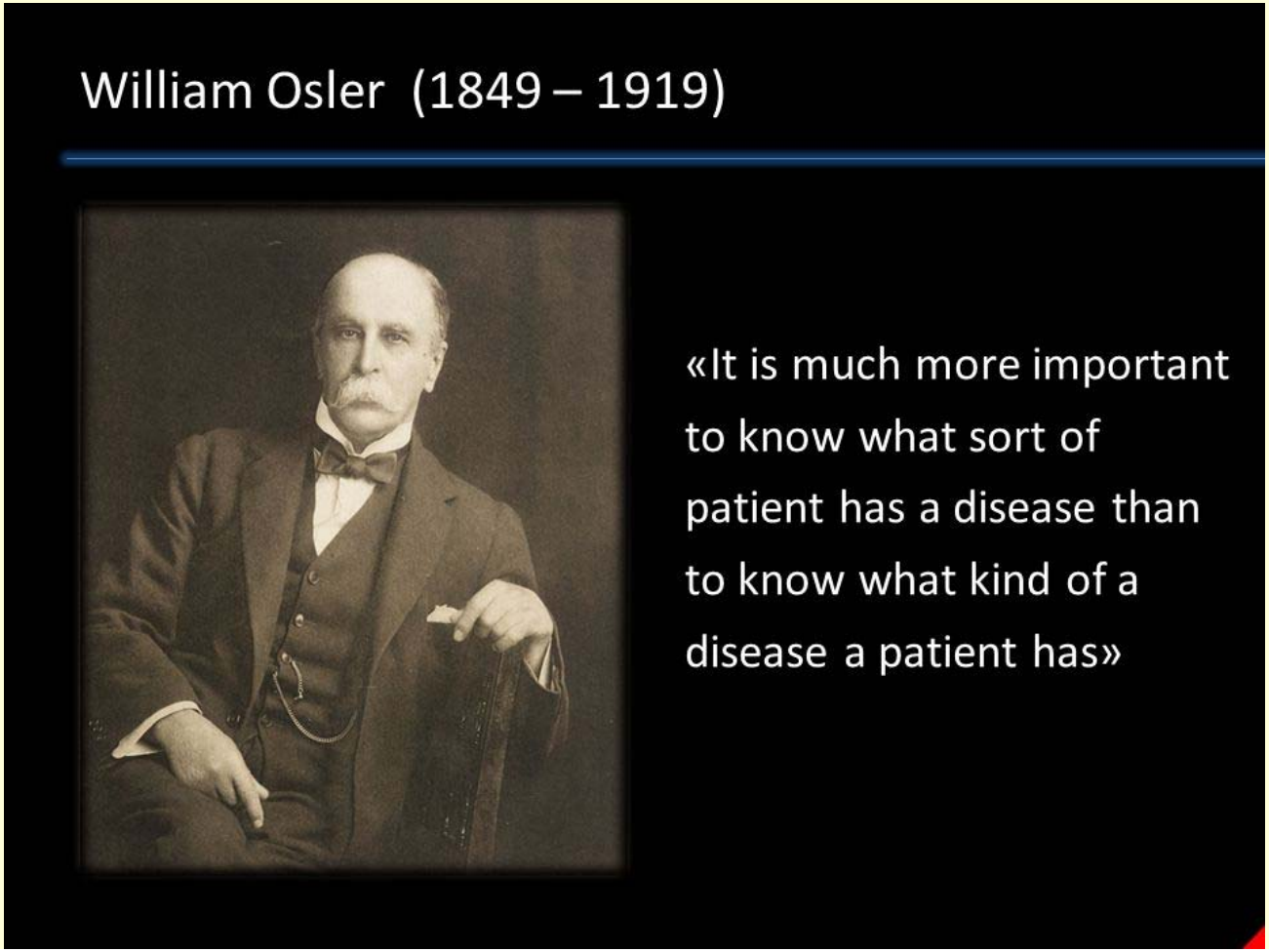


Table 3. Prevalence (%) of Current (Past Month) DSM Axis I Mental Disorders: A Comparison of Study Patients (n = 1,323) and General Population Estimates

Mental Disorders in "Disabled" ~~WC Spinal Pain Patients~~

	Study Patients		Population Estimates		Odds Ratio	
DSM Disorder	%	95% CI	%	95% CI	Ratio	95% CI
Any disorder (excluding pain disorder)	64.9	(62, 68)	15.4	(15, 16)	10.2	(9.17, 11.25)
Major depression	56.2	(53, 59)	2.2	(2, 3)	57.0	(51.74, 62.88)
Dysthymia	1.0	(0, 2)	3.3	(3, 4)	0.3	(0.18, 0.50)
Any anxiety disorder	10.6	(9, 12)	7.3	(7, 8)	1.5	(1.25, 1.81)
Panic disorder	3.4	(32, 4)	0.5	(0, 1)	7.0	(5.13, 9.55)
Any substance disorder	14.1	(12, 16)	7.0	(7, 8)	2.2	(1.86, 2.56)
Alcohol abuse/dependence	4.3	(4, 5)	5.2	(5, 6)	0.8	(0.62, 1.08)
Drug abuse/dependence	10.7	(10, 12)	2.4	(2, 3)	4.9	(4.07, 5.83)

DSM = *Diagnostic and Statistical Manual of Mental Disorders*; CI = confidence interval.

Dersh J, et al. Spine 2006; 31 (10): 1156-62

Table 4. Prevalence (%) of DSM Axis II Personality Disorders: A Comparison of Study Patients (n = 1,323) and General Population Estimates

	Study Patients		Population Estimates		Odds Ratio	
DSM Personality Disorder	%	95% CI	%	95% CI	Ratio	95% CI
Any personality disorder	69.6	(67, 72)	14.8	(14, 16)	13.2	(11.98, 14.50)
Paranoid	30.8	(28, 33)	4.4	(4, 5)	9.7	(8.71, 10.73)
Schizoid	2.6	(2, 3)	3.1	(3, 3)	0.8	(0.59, 1.18)
Schizotypal	4.5	(3, 6)	0.0–5.6*	NA	NA	NA
Antisocial	4.5	(3, 6)	3.6	(3, 4)	1.3	(0.96, 1.63)
Borderline	27.9	(25, 30)	0.4–4.6*	NA	NA	NA
Histrionic	17.3	(15, 19)	1.8	(2, 2)	11.2	(9.82, 12.68)
Narcissistic	13.8	(12, 16)	0.0–0.4*	NA	NA	NA
Avoidant	12.7	(11, 14)	2.4	(2, 3)	6.0	(5.16, 7.01)
Dependent	7.3	(6, 9)	0.5	(0, 1)	16.0	(13.30, 19.24)
Obsessive-compulsive	15.9	(14, 18)	7.9	(7, 8)	2.2	(1.91, 2.56)
Any personality disorder NOS	16.6	(17, 21)	NA	NA	NA	NA

DSM = *Diagnostic and Statistical Manual of Mental Disorders*; PD = personality disorder; NESARC = National Epidemiologic Survey on Alcohol and Related Conditions; CI = confidence interval; NOS = not otherwise specified; NA = not available.
*NESARC data for schizotypal, borderline, and narcissistic PDs unavailable; used a range of estimates from a series of earlier studies of nonclinical samples.[46–50]

Do Surgeons Detect Psych Issues?

- Daubs MD, et al. JBJS 2010; 92: 2878-83
- Prospective study of 1 Spine clinic in Utah
- **4 spine surgeons vs 4 Non-Operative spine doctors.**
- 400 patients assessed by DRAM questionnaires and by the MDs.
- A large percentage of patients **(64%)** presenting for spine evaluation have some level of psychological distress.
- When compared with a standardized questionnaire designed to screen for psychological distress, **spinal surgeons had low sensitivity rates** to detect this distress

TABLE IV Sensitivity, Specificity, and Positive Predictive Value for Physician Subgroups: Surgeons vs. Nonoperative Specialists*

DRAM Categorization (Outcome Treated as Positive)	Sensitivity *(pts/total pts [%])*	95% CI	P Value	Specificity *(pts/total pts [%])*
DD or DS (vs. N or R)†				
Surgeons	10/51 (19.6%)	(9.8%, 33.1%)	0.03§	157/170 (92.4%)
Nonoperative specialists	15/36 (41.7%)	(25.5%, 59.2%)		128/143 (89.5%)
DD or DS or R (vs. N)‡				
Surgeons	77/154 (50.0%)	(41.8%, 58.2%)	0.042§	50/67 (74.6%)
Nonoperative specialists	37/100 (37.0%)	(27.6%, 47.2%)		69/79 (87.3%)

*N = normal; R = at risk; DD = distressed-depressive; and DS = distressed-somatic. DRAM = Distress and Risk Assessment Method. †DD or DS versus N or R indicates the sensitivity and specificity for the surgeons and nonoperative specialists compared with the DRAM for categorizing between the more distressed categories (DD and DS) and the N and R categories. ‡DD or DS or R versus N indicates the sensitivity and specificity for the surgeons and nonoperative specialists compared with the DRAM for categorizing between any level of distress (R, DD, DS) and the nondistressed N group. §The difference was significant.

JBJS 2010; 92; 2878-83

TABLE V Sensitivity and Specificity for Surgeon Subgroups: More-Experienced vs. Less-Experienced Surgeons*

DRAM Categorization (Outcome Treated as Positive)	Sensitivity *(pts/total pts [%])*	95% CI	P Value	Specificity *(pts/total pts [%])*	95% CI	P Value
Surgeons						
DD or DS (vs. N or R)†						
More experienced	5/34 (14.7%)	(5.0%, 31.1%)	0.27	113/118 (95.8%)	(90.4%, 98.6%)	0.02§
Less experienced	5/17 (29.4%)	(10.3%, 56.0%)		44/52 (84.6%)	(71.9%, 93.1%)	
DD or DS or R (vs. N)‡						
More experienced	52/104 (50.0%)	(40.0%, 60.0%)	1.0	38/48 (79.2%)	(65.0%, 89.5%)	0.22
Less experienced	25/50 (50.0%)	(35.5%, 64.5%)		12/19 (63.2%)	(38.4%, 83.7%)	

OPIOIDS

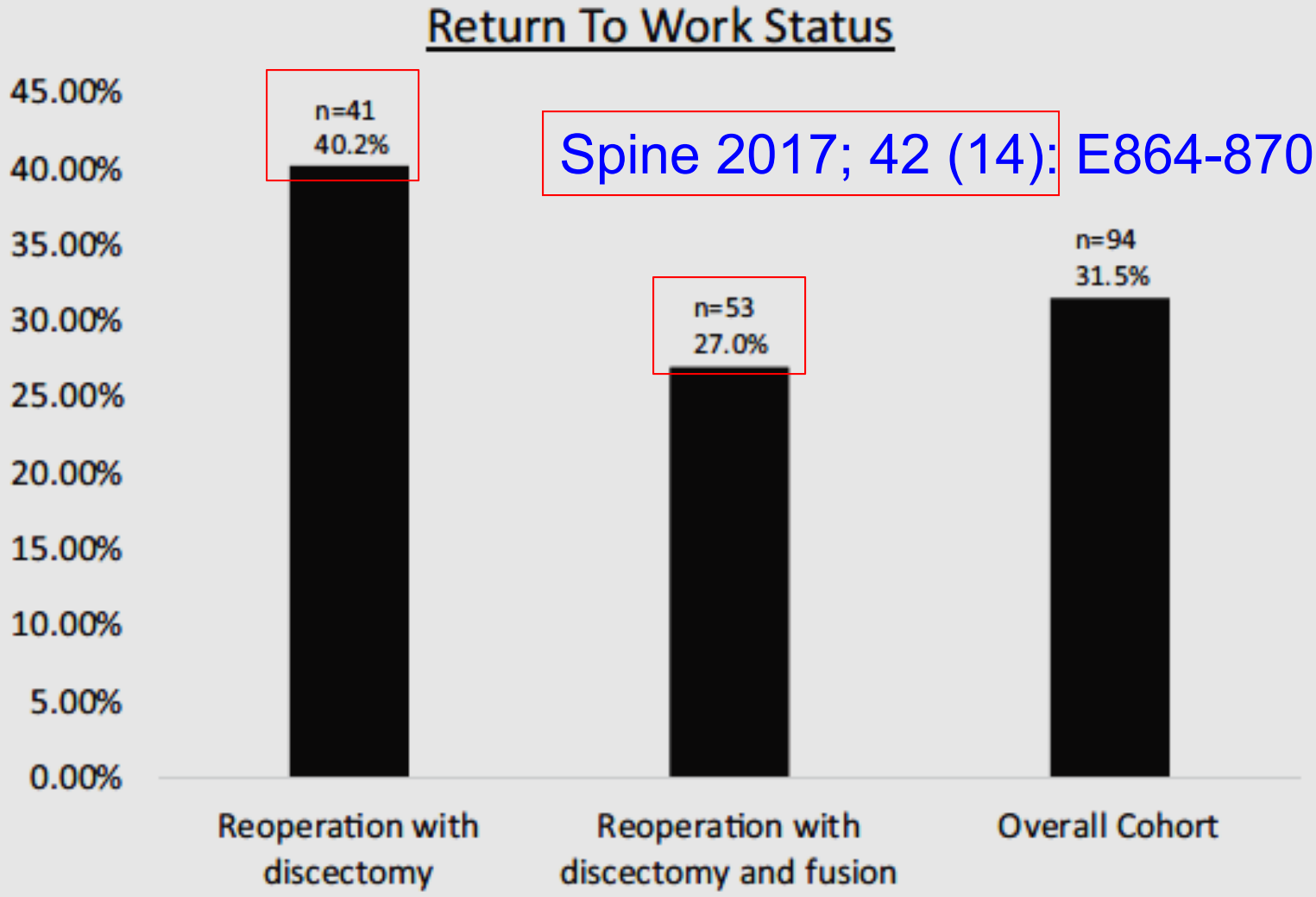
Spine 2015; 40: 1775-84

- Ohio WC: 1002 Lumbar **Fusions for DDD** in 1993-2013
  - 425 received Post-OP Opioids < 1Year after Fusion
  - 575 Received Opioids > 1 year after Fusion
    - In 3 years after fusion (1095 days) this group averaged **1083 days** of opioid therapy, 86% of which were Schedule II Opioids
    - **11% RTW rate**
- The **poor outcomes** of this study could **suggest a more limited role** for **discogenic fusion among WC patients.**

Spine **2017**; 42 (14): E864-870

Recurrent HNP

- Ohio Workers' Compensation – 10,592 Patients diagnosed with lumbar HNP 2005-2012
- **Excluded** multilevel surgery, **SMOKING**, and lumbar co-morbidity
- 102 patients had repeat discectomy
- 196 patients had repeat discectomy + **FUSION**
- Conclusion: "… suggests that fusion should be reserved for patients with clear indications for its use."

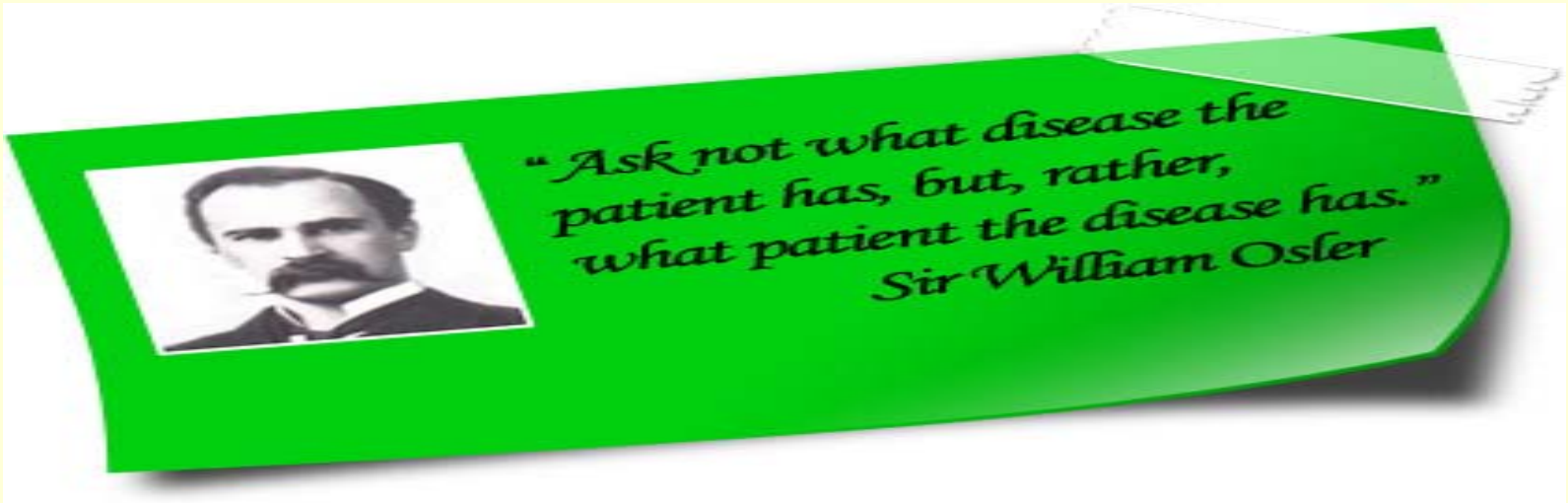


Spine 2017; 42 (14): E864-870

Figure 2. Return to work rates. Return to work rates after revision discectomy and fusion for RLDH were lower than those after revision discectomy alone (27.0% *vs* 40.2%; $P = 0.03$). RLDH indicates recurrent lumbar disc herniation.

Spine 2017; 42 (14): E864-870

- Multivariate Regression Analysis: Independent **NEGATIVE** Predictors of Return To Work
  - Discectomy + **FUSION**, **OR = 0.56**, p = 0.04
  - **Psychiatric Diagnosis**, **OR = 0.19**, p = <0.01
  - **Opioid Use** in the month PRIOR to surgery, Odds Ratio = **0.44**, p < 0.01



Spine 2017; 42 (13): 1017-23
Ohio WC Patients with **Stenosis**

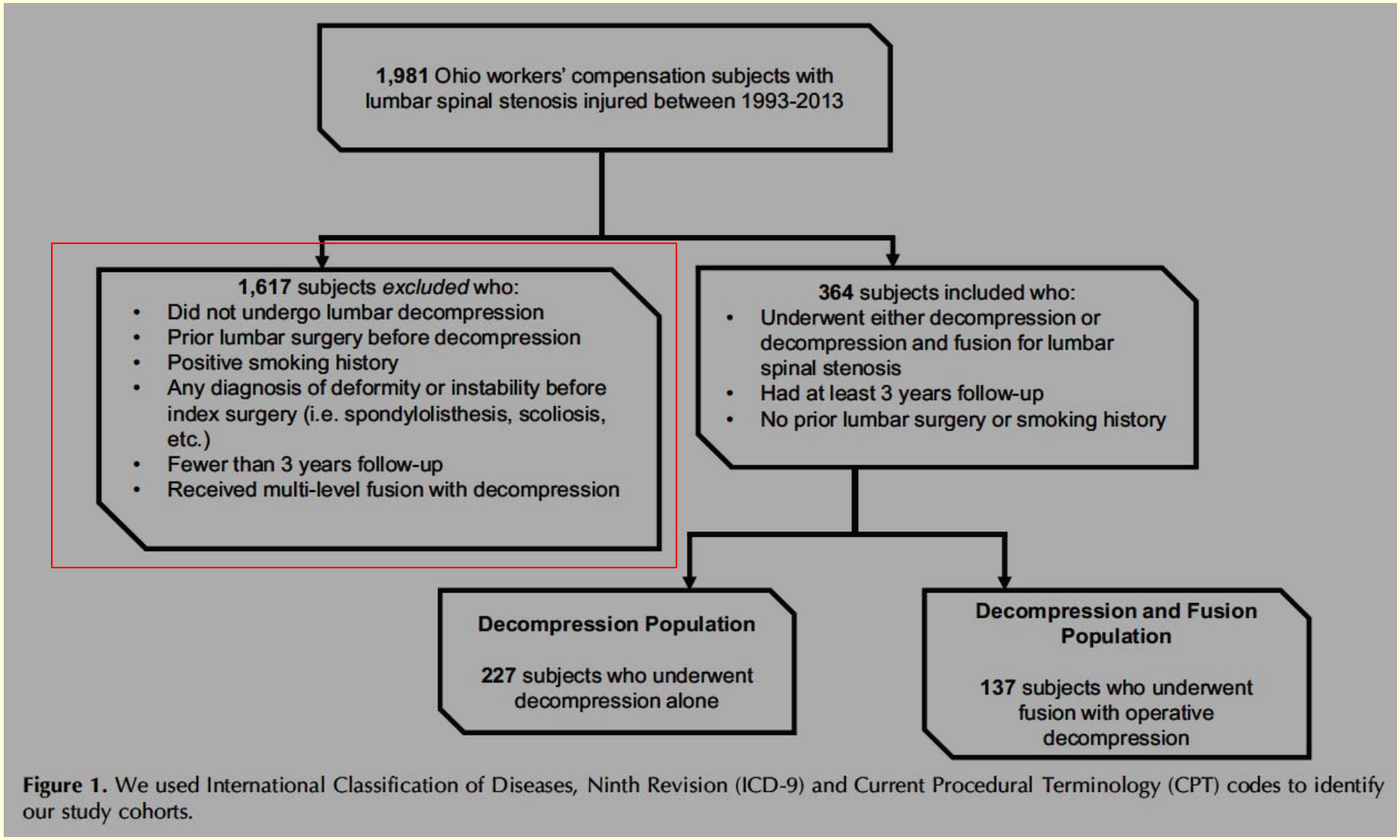


Figure 1. We used International Classification of Diseases, Ninth Revision (ICD-9) and Current Procedural Terminology (CPT) codes to identify our study cohorts.

Spine 2017; 42 (13): 1017-23
Ohio WC Patients with Stenosis

OutCome	Decompression	Decomp + FUSION	P Value
Return to Work	36%	24%	0.01
Mean Medical Cost	$ 95,902	$ 154,444	<0.01
Reoperation Rate	14%	17%	0.4
Re-Operation with fusion	8%	11%	

Conclusion: "… **fusion with decompression was a strong independent negative predictor of return to work**, despite controlling for other significant covariates.
The findings here suggest that the use of **fusion has a limited role** as an adjunctive therapy with decompression for the treatment of Lumbar Spinal **Stenosis without instability or deformity within the WC population."**

Spine 2017; 42 (13): 1017-23
Ohio WC Patients with Stenosis

TABLE 5. Predictors of Return to Work Status

Independent Variable	Odds Ratio	95% CI	*P*
Age	0.97	0.94–0.99	**0.04**
Income	1.002	1.0001–1.0003	**0.01**
Decompression and fusion	0.58	0.34–0.99	**0.04**
Psych diagnosis*	0.06	0.007–0.42	**<0.01**

Bold values represent statistical significance.

Odds ratios for continuous variables are reported per change in regressor over entire range.

**Before index surgery.*

CI indicates confidence interval.

Ohio Administrative Code 4123-6-32

- **Effective January 1, 2018**, **reimbursement** for lumbar fusion surgery for treatment of allowed conditions in a claim resulting from an allowed industrial injury or occupational disease **shall be limited to** claims in which **current best medical practices** as implemented by this rule are followed.

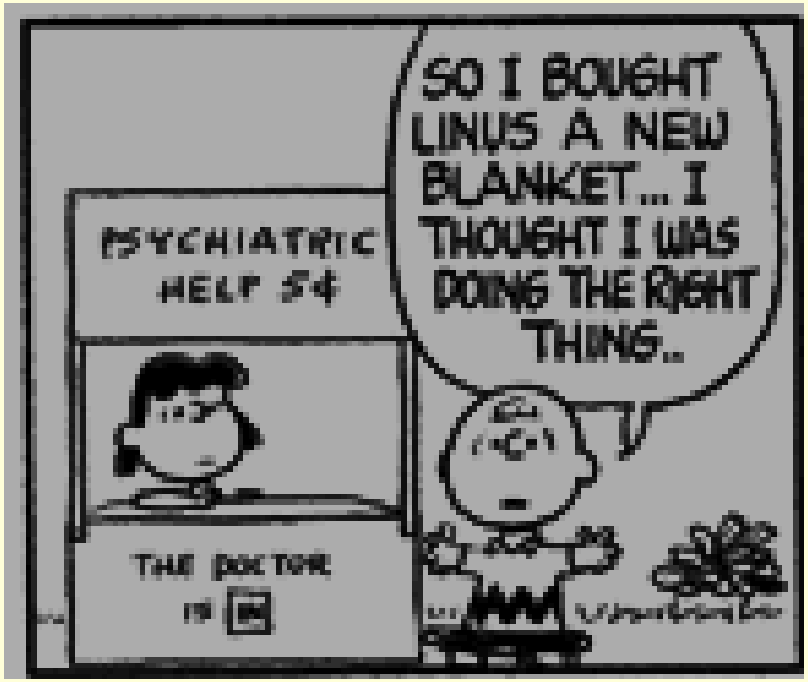
Basically Objective Instability, True Radiculopathy, AND Consensus Indications [fracture, infection, etc.]
Almost identical to Washington State Dept Labor & Industries

Ohio Administrative Code 4123-6-32

- A **provider's failure to comply** with the requirements of this rule **may constitute endangerment to the health and safety of injured workers**, and claims involving lumbar fusion surgery not in compliance with this rule may be **subject to peer review** by the bureau of workers' compensation stakeholders' health care quality assurance advisory committee (HCQAAC) pursuant to rule 4123-6-22 of the Administrative Code or other peer review committee established by the bureau.

Summary: *Guidelines*
are a neat way to "wrap up"
how to treat low back pain,
and other work related problems.

Lucy's Lament



Lumbar Fusion for Low Back Pain
in Workers' Compensation,
We thought we were doing the right thing.

The End

Thank You

Psychosocial

We frequently
fail to understand
that some patients
who complain of
somatic pain
are really expressing
anxiety and
depression,
and **not nociception.**

"Psychosclerosis": = Hardening of

Studies on Psychosocial Factors and Musculoskeletal Outcomes

When I Chose Orthopaedics and NOT Psychiatry,

I thought Ortho was as FAR as I could get

from Psychiatry.

Starr AJ. JBJS 2008; 90 (Suppl 1): 132-7

- Outcomes research has exposed evidence of widespread psychological distress following **musculoskeletal** trauma.
- Multiple studies have documented high rates of psychological distress among patients with musculoskeletal trauma.
- Psychological distress is **strongly associated with patient outcome**—including functional outcome—following trauma.

Starr AJ. JBJS 2008; 90 (Suppl 1): 132-7

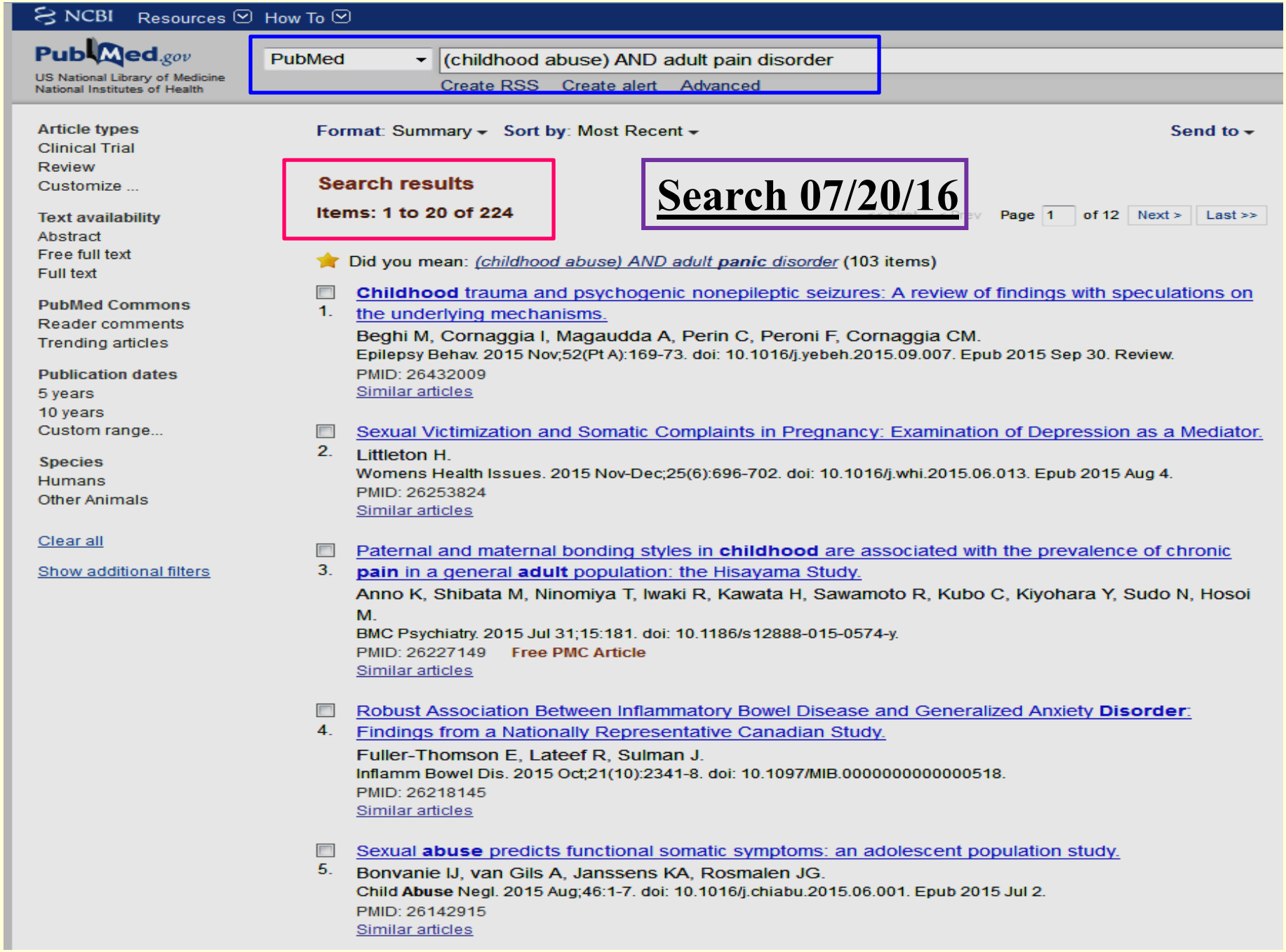
- Despite this strong association, no study evaluating the ability of clinicians to treat psychological distress after musculoskeletal trauma has been reported in the literature to my knowledge as of the time of this writing, nor do **orthopaedic** studies routinely control for psychological distress when evaluating **outcome.**
- **Psychological distress after trauma**, with its large impact on trauma outcomes, remains a substantial problem that **is usually ignored and untreated.**

Vranceanu AM, et al. JBJS 2009; 91: 2014-8

- "Current Concepts Review" [David Ring]
  - Psychosocial factors are important determinants of pain intensity and disability in patients with **disabling musculoskeletal pain**.
  - The **psychosocial aspects of disabling musculoskeletal pain include** cognitive (e.g., beliefs, expectations, and coping style), affective (e.g., depression, pain anxiety, heightened concern about illness, and anger), behavioral (e.g., avoidance), social (e.g., secondary gain), and cultural factors

Childhood Maltreatment and Adult Mental Disorders

- Scott KM, et al. Br J of Psychiatry 2012; 200: 469-75
- Childhood maltreatment was associated with elevated odds of **mood, anxiety and drug disorders** (odds ratios = 2.1–4.1), with no difference in association strength between prospective and retrospective groups.



NCBI Resources How To

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PubMed (childhood abuse) AND adult pain disorder
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Search 07/20/16

Page 1 of 12 Next > Last >>

Did you mean: *(childhood abuse) AND adult **panic** disorder* (103 items)

1. **Childhood** trauma and psychogenic nonepileptic seizures: A review of findings with speculations on the underlying mechanisms.
Beghi M, Cornaggia I, Magaudda A, Perin C, Peroni F, Cornaggia CM.
Epilepsy Behav. 2015 Nov;52(Pt A):169-73. doi: 10.1016/j.yebeh.2015.09.007. Epub 2015 Sep 30. Review.
PMID: 26432009
Similar articles

2. Sexual Victimization and Somatic Complaints in Pregnancy: Examination of Depression as a Mediator.
Littleton H.
Womens Health Issues. 2015 Nov-Dec;25(6):696-702. doi: 10.1016/j.whi.2015.06.013. Epub 2015 Aug 4.
PMID: 26253824
Similar articles

3. Paternal and maternal bonding styles in **childhood** are associated with the prevalence of chronic **pain** in a general **adult** population: the Hisayama Study.
Anno K, Shibata M, Ninomiya T, Iwaki R, Kawata H, Sawamoto R, Kubo C, Kiyohara Y, Sudo N, Hosoi M.
BMC Psychiatry. 2015 Jul 31;15:181. doi: 10.1186/s12888-015-0574-y.
PMID: 26227149 Free PMC Article
Similar articles

4. Robust Association Between Inflammatory Bowel Disease and Generalized Anxiety **Disorder**: Findings from a Nationally Representative Canadian Study.
Fuller-Thomson E, Lateef R, Sulman J.
Inflamm Bowel Dis. 2015 Oct;21(10):2341-8. doi: 10.1097/MIB.0000000000000518.
PMID: 26218145
Similar articles

5. Sexual **abuse** predicts functional somatic symptoms: an adolescent population study.
Bonvanie IJ, van Gils A, Janssens KA, Rosmalen JG.
Child **Abuse** Negl. 2015 Aug;46:1-7. doi: 10.1016/j.chiabu.2015.06.001. Epub 2015 Jul 2.
PMID: 26142915
Similar articles

Systematic Review: Sexual Abuse and Somatic Disorders

- Paras ML, et al. JAMA 2009; 302 (5): 550-61.
- 23 eligible studies describing 4640 subjects.
- There was a significant association between a history of sexual abuse and lifetime diagnosis of
  - **functional gastrointestinal disorders** (OR, 2.43; 95% CI, 1.36-4.31; I^2=82%; 5 studies),
  - **Nonspecific chronic pain** (OR, 2.20; 95% CI, 1.54-3.15; 1 study),
  - **psychogenic seizures** (OR, 2.96; 95% CI, 1.12-4.69, I2=0%; 3 studies), and
  - **chronic pelvic pain** (OR, 2.73; 95% CI, 1.73-4.30, I^2=40%; 10 studies).

Vranceanu AM, et al. JBJS 2014; 98: e20 (1-6)
http://dx.doi.org/10.2106/JBJS.L.00479

- 136 Adults with **Operatively treated fractures** at Massachusetts General Hospital.
- In our study, roughly one-quarter of the patients recovering from a fracture had an estimated diagnosis of clinical **depression** and **PTSD** early in the recovery period, and **psychological factors** —catastrophic thinking, in particular— **accounted best for the variation in pain intensity and disability** after skeletal trauma.

Pain & Mental Disorders

- Beesdo K, et al. Soc Psychiat Epidemiol **2010**; 45: 89-104.
- 4181 German Adults – Used DSM-IV
- Logistic regressions revealed that **pain is associated with both specific anxiety and depressive disorders**, with increasing significant odds ratios (OR) for medically explained pain symptoms (OR range: 1.9–2.0), to **unexplained pain symptoms** (OR range: 2.4–7.3), to Pain Disorder (OR range: 3.3–14.8).

Psychosocial

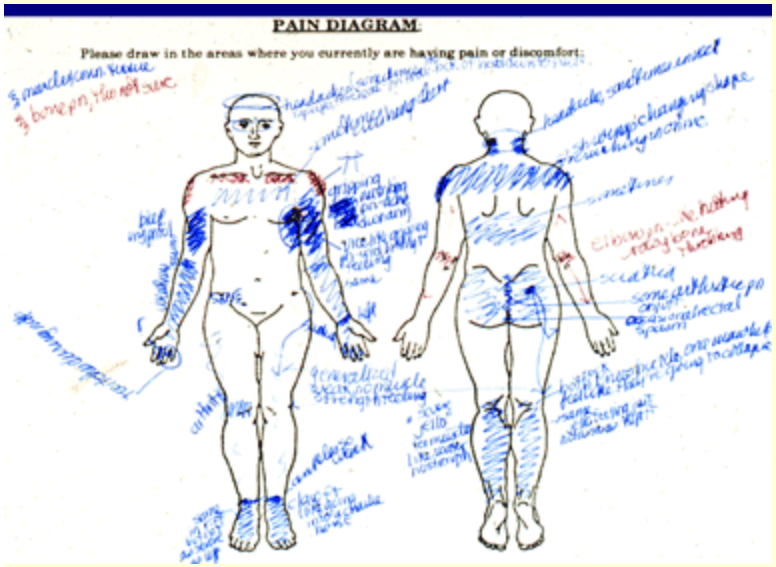
We frequently
fail to understand
that some patients
who complain of
somatic pain
are really expressing
anxiety and
depression,
and **not nociception.**

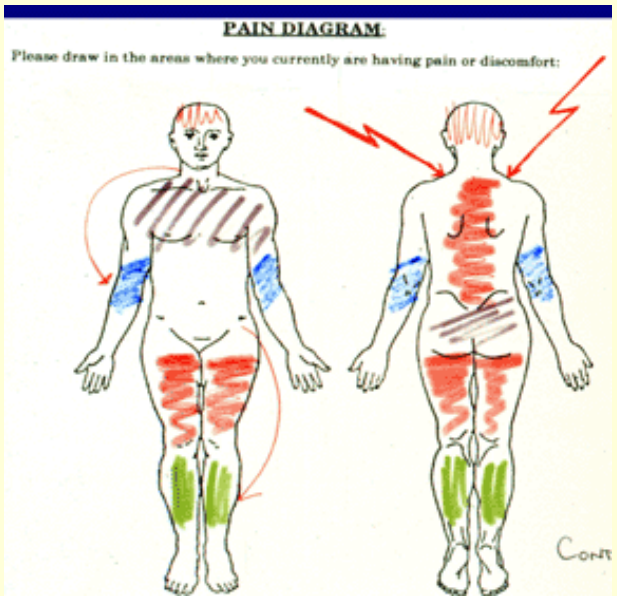
Idioms

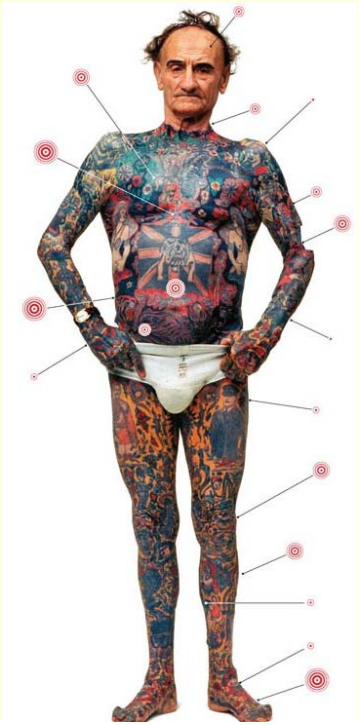
- "Raining Cats and Dogs"
  - **Thatched roof huts leaked heat** from the fireplace, so the warmest place for outdoor pets was the roof of the hut,
  - In heavy rains the roof became so slippery that the cats and dogs slid off the roof.

Idioms

- "My boss is a PAIN in the NECK."
  - My boss' behavior makes my neck hurt.
- "My spouse is a PAIN in the BUTT."
  - My spouse's behavior makes my low back and Buttock hurt.







Idioms

- You **HURT** my feelings when you …
- I went through a **PAINFUL** divorce.
- Losing Mother at such a young age was very **TRAUMATIC.**
- To a parent there is no other **HURT,** like the **PAIN** of the death of a child.
- The Thrill of Victory and the **AGONY** of Defeat…
- Getting fired from my job **WOUNDED** me badly.
- She **BROKE** my heart when she said "It's over."

Meerwijk EL, et al. Brain Imaging & Behavior 2013; 7: 1-14

- Brain Regions Involved in Psychological Pain.
- **The proposed neural network for psychological pain overlaps to some extent with brain regions involved in physical pain**, but results suggest a markedly reduced role for the insula, caudate, and putamen during psychological pain.

Table 3. Prevalence (%) of Current (Past Month) DSM Axis I Mental Disorders: A Comparison of Study Patients (n = 1,323) and General Population Estimates

Mental Disorders in "Disabled" ~~WC Spinal Pain~~ Patients

	Study Patients		Population Estimates		Odds Ratio	
DSM Disorder	%	95% CI	%	95% CI	Ratio	95% CI
Any disorder (excluding pain disorder)	64.9	(62, 68)	15.4	(15, 16)	10.2	(9.17, 11.25)
Major depression	56.2	(53, 59)	2.2	(2, 3)	57.0	(51.74, 62.88)
Dysthymia	1.0	(0, 2)	3.3	(3, 4)	0.3	(0.18, 0.50)
Any anxiety disorder	10.6	(9, 12)	7.3	(7, 8)	1.5	(1.25, 1.81)
Panic disorder	3.4	(32, 4)	0.5	(0, 1)	7.0	(5.13, 9.55)
Any substance disorder	14.1	(12, 16)	7.0	(7, 8)	2.2	(1.86, 2.56)
Alcohol abuse/dependence	4.3	(4, 5)	5.2	(5, 6)	0.8	(0.62, 1.08)
Drug abuse/dependence	10.7	(10, 12)	2.4	(2, 3)	4.9	(4.07, 5.83)

DSM = *Diagnostic and Statistical Manual of Mental Disorders*; CI = confidence interval.

Dersh J, et al. Spine 2006; 31 (10): 1156-62

Table 4. Prevalence (%) of DSM Axis II Personality Disorders: A Comparison of Study Patients (n = 1,323) and General Population Estimates

	Study Patients		Population Estimates		Odds Ratio	
DSM Personality Disorder	%	95% CI	%	95% CI	Ratio	95% CI
Any personality disorder	69.6	(67, 72)	14.8	(14, 16)	13.2	(11.98, 14.50)
Paranoid	30.8	(28, 33)	4.4	(4, 5)	9.7	(8.71, 10.73)
Schizoid	2.6	(2, 3)	3.1	(3, 3)	0.8	(0.59, 1.18)
Schizotypal	4.5	(3, 6)	0.0–5.6*	NA	NA	NA
Antisocial	4.5	(3, 6)	3.6	(3, 4)	1.3	(0.96, 1.63)
Borderline	27.9	(25, 30)	0.4–4.6*	NA	NA	NA
Histrionic	17.3	(15, 19)	1.8	(2, 2)	11.2	(9.82, 12.68)
Narcissistic	13.8	(12, 16)	0.0–0.4*	NA	NA	NA
Avoidant	12.7	(11, 14)	2.4	(2, 3)	6.0	(5.16, 7.01)
Dependent	7.3	(6, 9)	0.5	(0, 1)	16.0	(13.30, 19.24)
Obsessive-compulsive	15.9	(14, 18)	7.9	(7, 8)	2.2	(1.91, 2.56)
Any personality disorder NOS	16.6	(17, 21)	NA	NA	NA	NA

DSM = *Diagnostic and Statistical Manual of Mental Disorders*; PD = personality disorder; NESARC = National Epidemiologic Survey on Alcohol and Related Conditions; CI = confidence interval; NOS = not otherwise specified; NA = not available.
*NESARC data for schizotypal, borderline, and narcissistic PDs unavailable; used a range of estimates from a series of earlier studies of nonclinical samples.[46–50]

Systematic Review **Tests** for Discogenic Back Pain

- Willems PC, et al. The Spine J 2013; 13: 99-109
- **Ten studies** met the eligibility criteria.
- **Statistical pooling was not feasible** because of different test protocols, variability in outcome assessment, and heterogeneous patient populations.
- No studies reporting on facet joint blocks or MRI could satisfy the inclusion criteria.
- Obscure patient selection, high risk of verification bias, and outcome assessment with poorly validated instruments **precluded strong conclusions for all tests**.

Systematic Review Tests for Discogenic Back Pain

- Willems PC, et al. The Spine J 2013; 13: 99-109
- Ten studies met the eligibility criteria.
- Immobilization by an orthosis (median [range] positive LR, 1.10 [0.94–1.13] and negative LR, 0.92 [0.39–1.12]),
- **provocative discography** (median [range] positive LR, 1.18 [0.70–1.71] and negative LR, 0.74 [0.24–1.40]), and
- temporary external fixation (median [range] positive LR, 1.22 [1.02–1.74] and negative LR, 0.58 [0.15–0.94]) **failed to show clinically useful prognostic accuracy.**

Systematic Review Tests for Discogenic Back Pain

- Willems PC, et al. The Spine J 2013; 13: 99-109
- CONCLUSIONS: No subset of patients with chronic LBP could be identified for whom spinal fusion is a predictable and effective treatment.
- Best evidence does not support the use of current tests for patient selection in clinical practice.

Blue Cross Blue Shield North Carolina

- 2011 Coverage Decision

BCBSNC will not provide coverage for lumbar spine arthrodesis (fusion) surgery when it is considered not medically necessary.

1. Lumbar spine arthrodesis (fusion) surgery is considered not medically necessary unless one of the above conditions is met.

2. Lumbar spinal fusion is also considered not medically necessary if the sole indication is any one or more of the following conditions:

- Disc Herniation
- Degenerative Disc Disease
- Initial discectomy/laminectomy for neural structure decompression
- Facet Syndrome

– https://www.bluecrossnc.com/sites/default/files/document/attachment/services/public/pdfs/medicalpolicy/lumbar_spine_fusion_surgery.pdf

12/20/10 Prior to BC/BS NC Lumbar Fusion Pre-Authorization

- Source: AANS/CNS, AAOS, CNS, ISASS, NASS, POANA, SRS and the NC Neurological Society [https://ryortho.com/2010/12/spine-to-insurance-ldquounited-we-standrdquo/]
- Opposed "Not Covered Benefit" Status
- Proposed Criteria for Fusion for DDD
- *single or two level disc degeneration*
- *inflammatory endplate changes (i.e., Modic changes)*
- *moderate to severe disc space collapse*
- ***absence of significant psychological distress or psychological comorbidities** (e.g., depression, somatization disorder)*
- ***absence of litigation or compensation issues***
- *failure to respond to at least one year of non-operative care that includes physical and cognitive therapy*

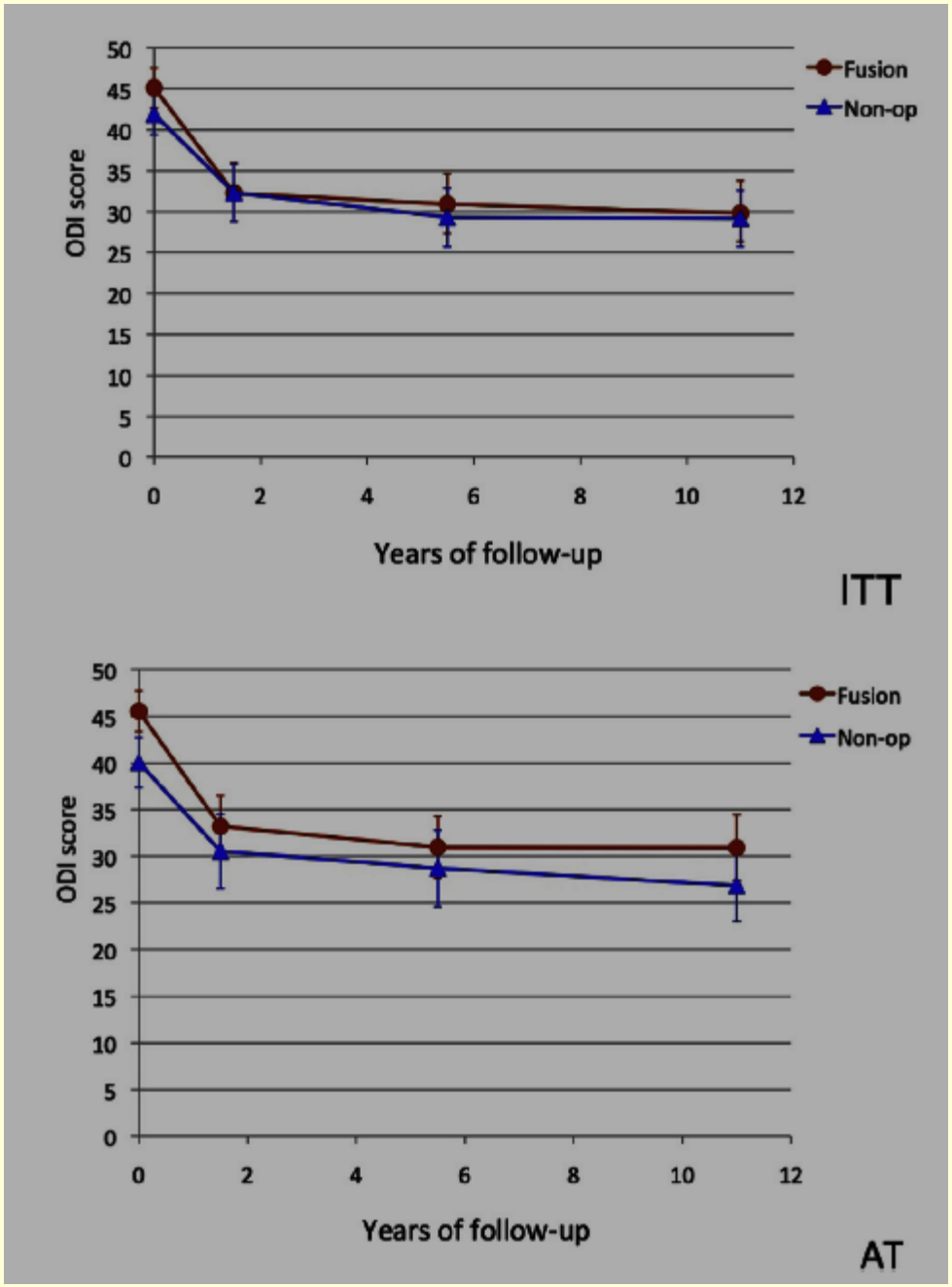
RCTs: Fusion for Non-Specific LBP

- Mirza SK Spine **2007**; 32 (7): 816-23
- All randomized trials enrolled similar subjects. [?]
- **One study** suggested greater improvement in back-specific disability
- for fusion compared to unstructured nonoperative care at 2 years, but the trial did not report data according to intent-to-treat principles.
- **Three trials suggested no substantial difference** in disability scores at 1-year and 2-years when fusion was compared to a 3-week cognitive-behavior treatment addressing fears about back injury.
- However, 2 of these trials were underpowered to identify clinically important differences.
- The third trial had high rates of cross-over (20% for each treatment) and loss to follow-up (20%);
- it is **unclear** how these affected results.

Long Term Follow Up of 4 RCTs

- Mannion AF, et al. The Spine J 2013; 13: 1438-48
- Pooled 473 Candidates for Lumbar Fusion
- 261 (55%) available from:
  - Brox: Spine 2003; 28: 1913-21
  - Fairbank: BMJ 2005; 330: 1233
  - Brox: Pain 2006; 122: 145-55

- for long-term follow up
  - Average 11.4 years, range 8-15 years
  - Adjusted for age, baseline ODI, prior surgery, duration of LBP, sex, and smoking.
  - **NO Relevant Differences in ODI or secondary outcomes**



The Spine J 2013; 13: 1438-48

- "The study supports previous reports that both spinal fusion and multidisciplinary cognitive-behavioral and exercise rehabilitation programs are associated with a reduction in disability in selected patients with cLBP.
- However, it cannot ascertain whether either of the interventions improved the patients' LBP status more in the long term, over and above natural history or a placebo effect.
- The study does not provide any evidence for one treatment being beneficial over the other in terms of self-rated disability and other secondary outcomes in the long-term perspective."

Swedish Lumbar Spine Study Group RCT for Back Pain

- Spine **2001**; 26: 2521-34
- 294 Patients, 19 Centers, 26 Surgeons,
- 1992-98 (7 years)
- Randomized to Surgery or Continuing (Failed) Non-Operative care (n=72)
  - Posterolateral fusion n=73 (PLF)
  - PLF with pedicle screws N=74
  - PLF Plus ALIF or PLIF (circumferential fusion)

Swedish Lumbar Spine Study Group RCT for Back Pain

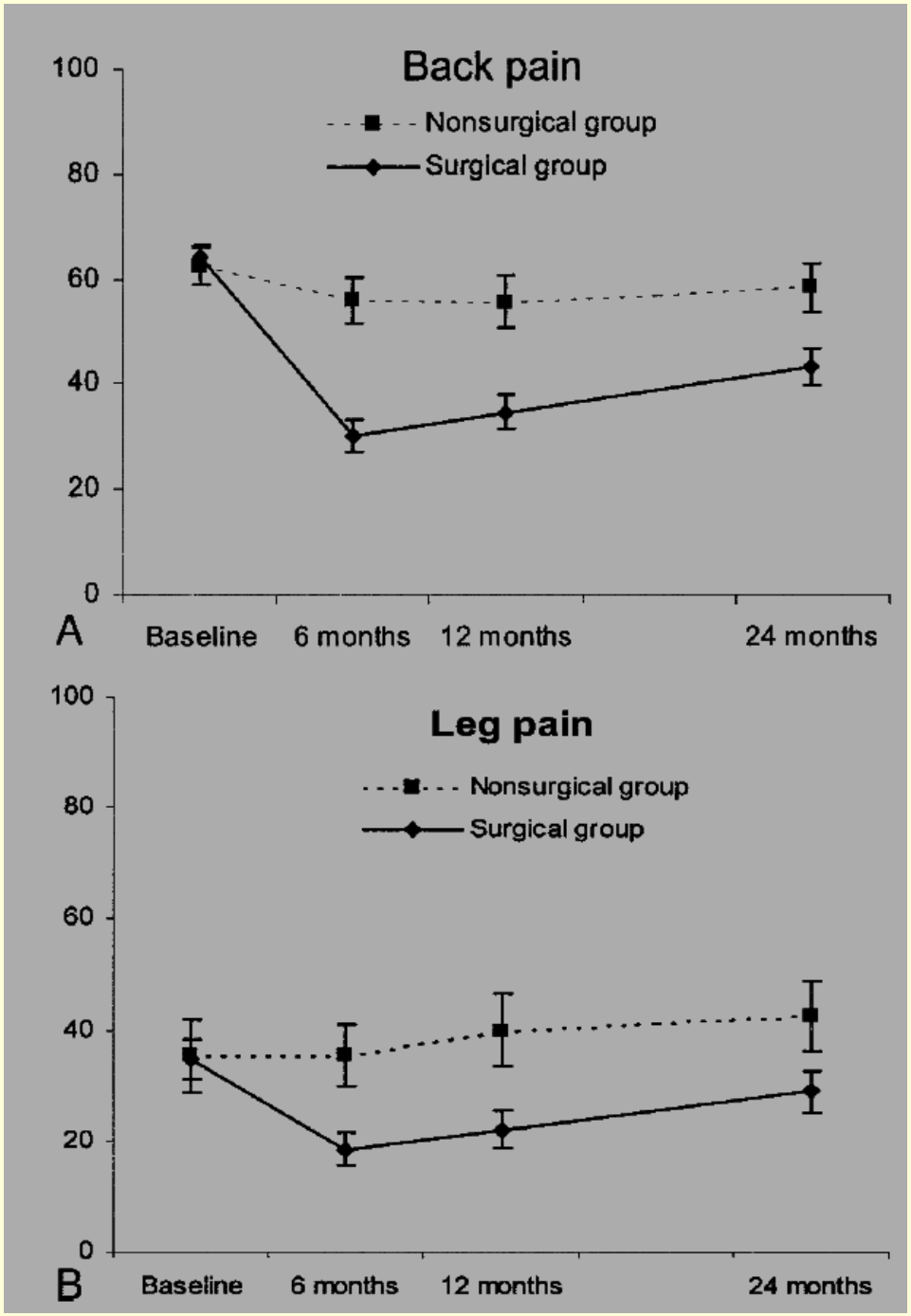
- Spine 2001; 26: 2521-34
- 294 Patients, 19 Centers, 26 Surgeons,
- 1992-98 (7 years)
- 222 + 72 = 294 total patients
- **Each surgeon averaged recruiting 1.6 patients per year.**
  - 26 surgeons X 7 years = 182 “surgeon-years”
  - 294 patients ÷ 182 = 1.6 patients/surgeon/year

- Abstract says "overall result" (i.e. Global patient assessment) "by the patient" was recorded, but was **NOT reported**
  - **"Better", "Same", or "Worse"**

Table 3. Back and Leg Pain, Disability, and Depressive Symptoms

	Surgical group (n = 201)				Nonsurgical group (n = 63)				Diff baseline-2 years				
	Baseline	2 years fu	Diff %	*P*-value*	Missing	Baseline	2 years fu	Diff %	*P*-value*	Missing	Surgery	Non-surg	Diff *P*-value
VAS Back	64.2 (14.3)	43.2 (25.2)	32.7	<0.0001	6	62.6 (14.3)	58.3 (18.8)	6.8	0.017	1	21.0	4.3	0.0002
VAS Leg	35.3 (25.4)	29.0 (27.0)	17.8	0.002	9	35.6 (25.2)	42.6 (24.8)	−20.5	0.219	4	6.3	−7.0	0.005
ODI	47.3 (11.4)	35.7 (18.0)	24.5	<0.0001	4	48.4 (11.9)	45.6 (16.1)	5.8	0.025	1	11.6	2.8	0.015
MVAS	63.7 (11.3)	45.6 (23.1)	28.4	<0.0001	4	65.5 (11.5)	60.4 (17.2)	7.8	0.021	2	18.1	5.1	0.004
GFS	49.1 (15.9)	34.1 (22.4)	30.5	<0.0001	7	47.6 (16.3)	45.5 (20.3)	4.4	0.073	2	15.0	2.1	0.005
Zung	39.1 (13.3)	31.4 (15.2)	19.7	<0.0001	10	39.4 (13.9)	36.7 (14.5)	6.9	0.041	2	7.7	2.7	0.123

Group changers + dropouts (18 + 3 in the surgical group and 7 + 2 in the nonsurgical group) were excluded from the illustrated results, but group changers were included in the analyses of difference, consistent with the intention to treat principle.
The difference between the baseline value and the value after two years (diff %) was calculated on group level, and not on an individual level.
Pain was measured in mm on a vertical Visual Analogue Scale (VAS).
Disability was measured with the Oswestry Low Back Pain Questionnaire, the Million Score (MVAS), and General Function Scale (GFS).
Depression was measured with the Zung Depression Scale. All scales ranging from 0 to maximum severity 100.
All values are illustrated as means (Standard deviation within brackets), but nonparametric tests were used for statistical analyses.
The significance of the difference between baseline and 2 years follow-up within each group was calculated with the Wilcoxon Signed Rank test.*
The difference between the change in the two groups after 2 years was analysed with the Mann Whitney U Test.



Spine 2001; 26: 2521-34

- Age 25-65
- > 2 years LBP
- No nerve root compression
- L4-5 and/or L5-S1 by Hx, PE, X-ray
- > 1 year off work
- **No Obvious psychiatric illness**
- No prior surgery (except > 2 yr since simple discectomy)
- NO listhesis, fracture, infection, tumor, stenosis, or hip disease

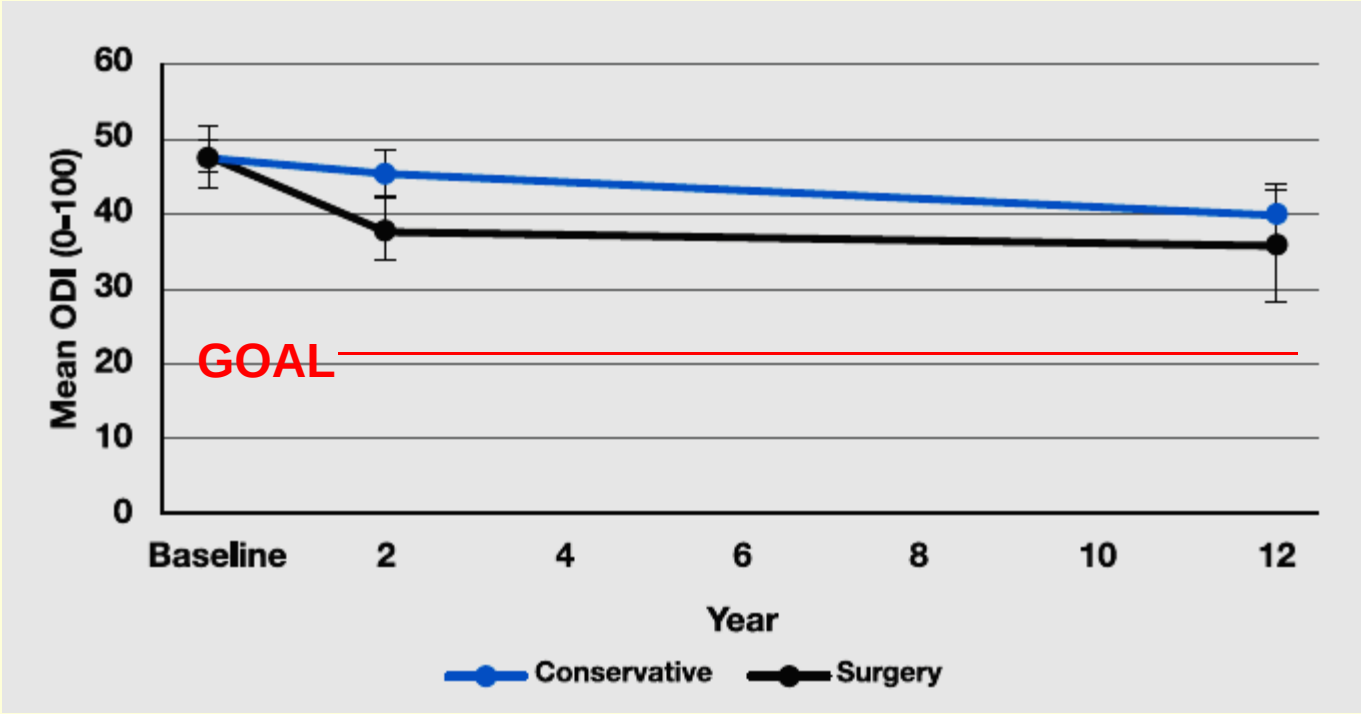
Demographics: Separate Publication Spine 2002; 27 (11): 1223-30

- Conclusions. The surgical candidates in the current study **resembled the average Swedish citizen** with back pain.
- **On the contrary they unexpectedly were affected only a little by depressive symptoms, distinguishing them from patients with chronic low back pain in pain clinics and rehabilitation centers.**
- Therefore, the **results of the this outcome study are not generally applicable** to every patient with chronic low back pain.

Hedlund R. et al. The Spine J 2016; 16: 579-87
Long-Term Follow Up Swedish Spine Study

- Mean follow up 12.8 years [range 9-22 years]
- 85% of subjects had data
- 26 of 72 (36%) in NON-Operative trial had surgery
- **NO difference** in ODI, VAS Back Pain, Pain Frequency, Pain Medication, and Work Status.
- Intention to Treat analysis: No benefit
- Per Protocol and As Treated had **slight** but statistically significant **improvement in "Global Assessment"**
  - "Better" , "Unchanged", or "Worse"

Hedlund R. et al. The Spine J 2016; 16: 579-87
Long-Term Follow Up Swedish Spine Study



- Fig. 2. **As treated analysis** of conservatively and fused patients. ODI score at baseline, at 2 years, and at mean 12.8 years follow-up.
- The difference at long-term follow-up was **statistically non-significant.**
- Error bars: 95% CI.

Problem with Global Assessment: Problem of Recall Bias

- Aleem IS, et al.

Spine 2017; 42: 128-134

- Mayo Clinic **Spine Surgery** Patients
- **Recall Bias** Affects Assessment by
- Patient stated **"Improvement"**

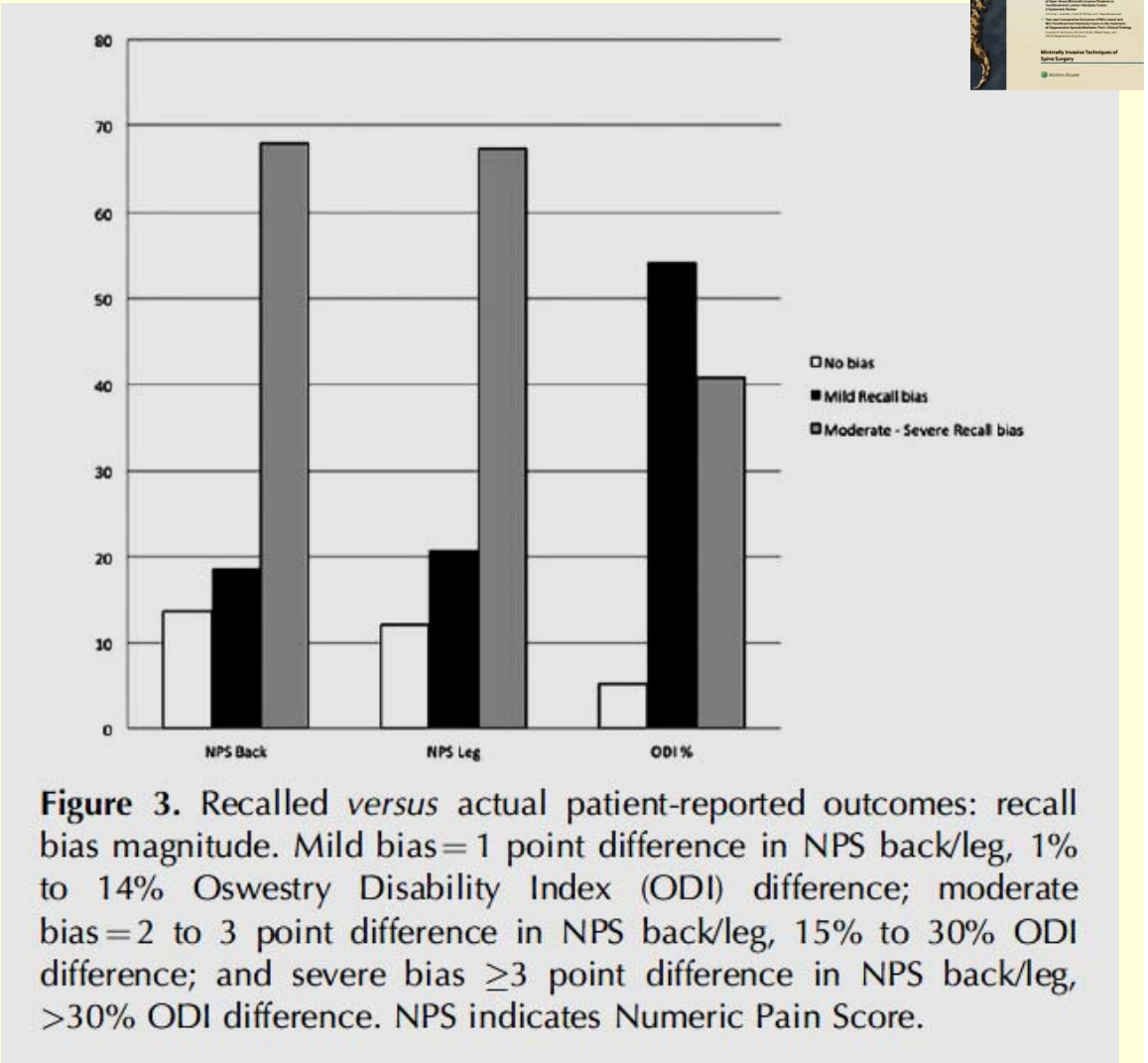


Figure 3. Recalled *versus* actual patient-reported outcomes: recall bias magnitude. Mild bias = 1 point difference in NPS back/leg, 1% to 14% Oswestry Disability Index (ODI) difference; moderate bias = 2 to 3 point difference in NPS back/leg, 15% to 30% ODI difference; and severe bias ≥3 point difference in NPS back/leg, >30% ODI difference. NPS indicates Numeric Pain Score.