Treating Chronic Pain for Functional Gain:

What works?

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Disclosure

• Dr. Bruns is the co-author of a published psychological test
Do Opioids Improve Function?

Opium poppy seed bulbs

CDC Study: All US Overdose Deaths 2000 – 2016, By Drug

- 20,000 deaths/year
- 15,000 deaths/year
- 10,000 deaths/year
- 5,000 deaths/year


20,100: Fentanyl
15,400: Heroin
14,400: Rx Opioids (Hydro- & oxycodone)

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In 2017:

- 17.4% of the entire U.S. population received one or more opioid prescriptions

- 26.3% of 55-64 y.o. Americans were prescribed an opioid (CDC, 2018)

- ~10% are likely to exhibit Sx of addiction

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**Per Capita Global Opioid Consumption in 2011**

- An alternate way to look at this data:

- Per capita in 2011 vs the rest of the world, persons in the USA consumed

  - 56 times more oxycodone

  - 6900 times more hydrocodone
Opioids have been the go to Rx

• Opioids prescribed for around 60% of emergency department presentations for low back pain in the USA.
  – Kao 2014

• More than half the total number of people taking opioids long-term have low back pain
  – Foster, 2018

Opioids have a paradoxical effect

• Short-term, opioids produce analgesia and euphoria

• The Risk: Exposure to opioids as short as five days may begin to produce long-term neuro-adaptations that increase pain.
  – Opioids disable pain blocking mechanisms (e.g. Mu opioid receptors)
  – Opioids activate pain enhancing mechanisms (e.g. release of pro-inflammatory cytokines)
  – Opioids promote CNS alterations that impact pain including metabolic, structural and epigenetic changes
  – (Rivat, 2016)
Opioids Remodel the Pain Sensory System

Opioid tolerance results from fewer and desensitized Mu receptors. High opioid concentrations are needed to activate Mu receptors, and endorphins are ineffective.

Mu opioid receptor
Endorphin
Morphine

Opioids and Functioning

• Physical functioning on opioids
  – After adjusting for disease severity, patients taking opioids had a lower level of functioning and greater disability
  – Bostick, 2015

• No evidence opioids increase RTW
  – Deyo, 2015

• Chronic opioid therapy should be discontinued if there is no demonstrable functional benefit
  – ACOEM 2017 Opioid Guidelines
Opioids and Functioning

• **Cognitive functioning on opioids**
  – Meta-analysis of neuropsychological effects of opioids
  – Patients taking opioids exhibited deficits in 12 of 14 brain functions assessed
    • Effect sizes were revealed small-to-medium
    • Complex psychomotor abilities most impaired
  – Wollman, 2018

• **There is evidence that opioid use is incompatible with safety-critical jobs**
  – ACOEM Opioid Guidelines

Opioids temporarily alleviate pain while accelerating the transition to a chronic condition

(Rivat, 2016)

• Evidence suggests that opioids are best used for treating severe acute/post-operative pain (<4 weeks) (ACOEM, 2017)
• 62% of the patients who died from opioids had been treated for pain in the prior year (Olfson, 2017)
• 80% of new heroin users got started by first misusing prescription opioids for pain (HHS, 2016).
• There is no evidence that opioids work long term for pain (Chou, 2015)
### How Powerful is Fentanyl?

<table>
<thead>
<tr>
<th>Rx</th>
<th>Morphine Milligram Equivalents (MME)</th>
<th>Potency relative to morphine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codeine</td>
<td>100</td>
<td>1/10&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tramadol</td>
<td>100</td>
<td>1/10&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Morphine</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.1</td>
<td>100X</td>
</tr>
<tr>
<td>Remifentanil</td>
<td>0.1</td>
<td>100X</td>
</tr>
</tbody>
</table>

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### How Powerful is Remifentanil?

<table>
<thead>
<tr>
<th>Rx</th>
<th>MME</th>
<th>Strength of analgesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remifentanil</td>
<td>Plus Placebo</td>
<td>Doubled analgesic effect</td>
</tr>
<tr>
<td>Remifentanil</td>
<td>Plus Nocebo (Negative placebo)</td>
<td>No analgesic effect</td>
</tr>
</tbody>
</table>

Bingel, 2011

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Does Surgery Improve Function?

Lumbar Surgery Outcome

• In a study of patients undergoing lumbar fusion
  – Vertebral fusion was successful 84% of the time, but...
  – Half the patients were dissatisfied with the outcome
  – 38% were left totally disabled
  – (LaCaille, 2005)
When Surgery Fails?

Use Opioids!!

Post spinal fusion patients use 41% MORE opioids
(Nguyen, 2011)

The Nature of Pain
Pain and the brain. A conversation.

I love my job. Building houses is cool…

OUCH!!! What the heck was that???

It feels like something just bit my right foot!

[Thoughts accelerate]

What is going on!!!

[Heart rate increases]

Geez, my heart is beating hard!

[Reticular activating system]

[Heart rate increases]

[Prefrontal cortex]

{Later} It still hurts but it's my kid's birthday. I'm not going to think about it.

[Insular cortex]

This hurts like crazy but I need a plan.

[Prefrontal cortex]

{Later} It still hurts but it's my kid's birthday. I'm not going to think about it.

[Prefrontal cortex]

I got a staph infection from that stupid nail! Now my foot pain is a constant 10, and it never changes.

[Hippocampus]

Geez. My foot hurts so bad it makes me cry sometimes. My pain is stressing me out!

[Limbic system]

Will removing the pain generator stop the pain?

Acute Pain: Yes          Chronic Pain: No

Chronic pain is influenced more by central processes than peripheral pain generators.
Descartes thought that mind and body were separate, and that real pain was the direct result of tissue damage, which sent a signal to the brain.

Remarkably, 350 years later, this incorrect concept of pain is still commonly used.

Pain: A Two-Way Street

Red
Nerve Tracts Going Down (Efferant)

Blue
Nerve Tracts Going Up (Afferant)

Pain Transmission Signals Going Up
Pain Regulation Signals Going Down
Cross-section of Spinal Nerves and Their Effect on Pain and Somatic Symptoms

Graphic by Mikael Häggström, used with permission.
Adapted for pain by Daniel Bruns, PsyD

Where does pain sensory information go?

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Nerve type: Aβ or C
Nociceptor: Mechanical, thermal, chemical, or sleeping
Do Patients Feel Their Pain?

What is your pain level today? Did you answer from memory, or did you check?

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Chronic Pain Changes the CNS

• fMRI studies of the brain show that over time, chronic pain becomes less closely associated with sensation, and more closely associated with:
  • Arousal
  • Emotion
  • Cognition
  • Memory
  • (Geha 2008; Hashmi, 2013; Mansour, 2014)
Chronic Pain Changes the CNS

- Chronic pain is associated with
  - Windup in spinal cord ganglia (Staud, 2007)
  - Central sensitization in the brain (Melzak, 2006; 2007)
  - Reorganized brain functioning (Apkarian, 2009; May, 2008)
  - Structural changes to the brain including:
    - Signs of neurodegeneration (Apkarian, 2006)
    - Decreased grey matter in prefrontal cortex (Barad, 2014)
  - Memory impairment (Liu, 2014)

Psychological Treatments and the Brain

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CBT and Opioids

- Systematic review of opioid cessation studies (Frank, 2017)
  - Buprenorphine vs interdisciplinary methods
  - Buprenorphine Tx most common, but evidence supports interdisciplinary methods
    - Nonpharmacologic & self-management Tx
    - Less pain, better functioning after reducing opioids
    - But many low quality studies

CBT and Surgery

- Study of Lumbar fusion vs Cognitive Behavioral Therapy + Exercise.
- At 4 year follow-up patients receiving CBT + exercise:
  - Had the same level of pain
  - Had a higher level of physical and emotional functioning
  - Had a lower frequency of disability
  - Were less fearful of reinjury
  - Used less pain medication
  - Returned to work as often
  - Brox, 2010
For non-specific lumbar pain

- Lumbar fusion is not more effective than structured cognitive-behavior therapy.
  — Mirza, 2007

- CBT = PT for chronic low back pain
  — Smeets, 2006

- Nonsurgical, multidisciplinary treatment can reduce opioid use and improve physical and emotional functioning
  — Crisostomo, 2008

- Surgery costs 168x more than psych treatment, and has far more risks (Bruns and Disorbio, 2009)

As Opposed to Opioids: Behavioral Therapies

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- Hypnosis and Imagery Tx
- Behavioral and Mindfulness Therapies
- Affective Therapies
- Biofeedback
- Relaxation Training/Sleep Hygiene
- Solving Life Problems Related to Pain
- Cognitive Therapies, Pain Education
- Mindfulness Meditation
- Neuropsychological model of pain treatment
Psychological Tx Changes the Brain

• CBT therapy increased prefrontal cortex grey matter in the brains of
  – Pain patients (Seminowicz, 2013)
  – Chronic fatigue patients (de Lange, 2008)

• CBT increased blood O$_2$ level in prefrontal cortex of fibromyalgia patients (Jensen, 2012)

• CBT for anxiety decreased blood flow in brain emotion centers (Soravia, 2016)

Psychological Tx Changes the Brain

• 4 days mindfulness training reduced pain-related brain activity in the somatosensory cortex
  – Pain sensation down 40%; Pain affect down 57%
  – (Zeidan, 2011)

• Some psychological Tx are exercises for the brain, and induce neuroplasticity
What are the economics of behavioral treatments?

The payer perspective

Biopsychosocial Model and Cost

• Spine surgery can 100x CBT, sometimes 1000x
  – (Jain, 2018)
  – CBT or CBT + Physical Therapy is as effective as some surgeries (Brox, 2010; Chou, 2009; Mirza, 2007)

• CBT costs less than treatment with pain medication
  – OxyContin (40mg) alone = $900/month

• Colorado’s biopsychosocial guidelines
  – 15 yr big data study of 29 million patients tested economic effect of guidelines (Bruns, Mueller, Warren, 2012)
  – Saved estimated $859,000,000 in one year
Treatment Recommendations From Guidelines and Research

ACOEM 2017 “MDGuidelines” Chronic Pain Guidelines

• Psychological evaluation and treatment should be **strongly** considered for patients with chronic pain.

• A psychological evaluation is recommended as part of the evaluation and management of patients with chronic pain in order to assess whether psychological factors will need to be considered and treated as part of the overall treatment plan.
Colorado 2017 Chronic Pain Guidelines

• “There is strong evidence supporting CBT, particularly in conjunction with other active therapy” (p 132)

• “Interdisciplinary Rehabilitation Programs are the gold standard of treatment” (p 61)

Agency for Healthcare Research and Quality Noninvasive, Nonpharmacological Treatment for Chronic Pain

• AHRQ 2017 Systematic Review (Draft)
  – Psychological therapies have strongest strength of evidence for treating back pain of any treatments reviewed (pain & function gains)
Psychological Assessment

Severe emotional distress increases pain intensity

Extreme cognitions increase anxiety, depression and anger

Exercise avoidance leads to physical deconditioning

Disabling Chronic Pain

Catastrophizing

"My pain is horrible!!!!"

Kinesiophobia

"Exercise hurts so bad, it's going to injure me!!!!"

Exercise is more difficult: "I need opioids to cope!"

Severe emotional distress increases pain intensity

Extreme cognitions increase anxiety, depression and anger

Exercise avoidance leads to physical deconditioning
Two Patterns of Substance Abuse

- Study based on 1252 subjects gathered from 106 sites in 36 US states, demographically matched to US Census data for gender, age, education, and ethnicity
  - “Average American Patient”: 527 patients in treatment for pain or injury
  - “Average American Community Member”: 725 community members
  - Total 1252 demographically-matched subjects
- Opioid risk measure development used regression, factor analytic and other methods
- Two clusters of substance abuse patterns emerged
- (Bruns and Disorbio, 2016)

Knowing the type of patient guides the intervention

- History of ACE, Trauma and Suicidality
- Substance-Related Criminal Hx
- Addiction Path
- Anger & Self Destructive Behavior
- Impulsivity & Lack of Social Achievement
- Painful Illness or Injury
- Pain Patient Path
- Craving & Conflicted Dependence
- Highly Distressed Patient
- Unrealistic Expectation of Easy Cure
- Presumed Precipitating Event
  - Two distinct item clusters with low intercorrelation of (.33)

Bruns and Disorbio, 2016
BHI 2 MIR

MEDICAL INTERVENTION RISK REPORT

Patient Profile

- BHI 2 Validity
  - Self-Disclosure: Raw 140, T 60
- Risk Factors
  - Primary: Raw 0, T 50
  - Presurgical: Raw 36, T 59
  - Rehabilitation: Raw 22, T 66
  - Addiction History: Raw 24, T 56
  - Addiction Potential: Raw 28, T 67
- Nonadaptive Coping Styles
  - Catastrophizing: Raw 20, T 61
  - Kinesiophobia: Raw 16, T 68

Scale

- Std T Score
- No primary risks or danger to self/others
- Elevated risk for surgery/rehab
- Percentile

Average Range Like CBC
Normal = 50

Not an "addict" profile
Likes opioids too much
Fearful of Exercise
Prevention
When do you intervene to prevent opioid dependence?

• **Pain psychology as subacute** Tx vs chronic
  – Earlier psych intervention for to prevent opioid dependence and unnecessary surgery

• **Psych referral @ 4-12 weeks and prior to:**
  – Chronic opioid therapy

End