School of Medicine
& Health Sciences
THE GEORGE WASHINGTON UNIVERSITY

Identifying and Managing Persistent Pain: All Pain is not Equal

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Presenter

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Dr. Jonely received her Master's Degree in Physical Therapy from Texas Tech University Health Sciences Center in 1999 and later her Doctor of Science in 2006. Dr. Jonely has also completed advanced training in manual therapy with the International Academy of Orthopedic Medicine (IAOM-US) and is a fellow of the American Academy of Orthopedic Manual Physical Therapists.

Disclosures

- Dr. Holly Jonely has no relevant financial or non-financial relationships to disclose relating to the content of this activity.
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Learning Objectives

At the conclusion of this knowledge-based activity, participants will be able to:

1. **Explain** the difference between primary **nociceptive** pain, **neuropathic**, and **nocioplastic pain**.
2. **Identify** the need to adopt a **biopsychosocial model** in the **evaluation** and **management** of persons with persistent pain.
3. **Summarize best evidence** for **management** of persons with persistent pain.

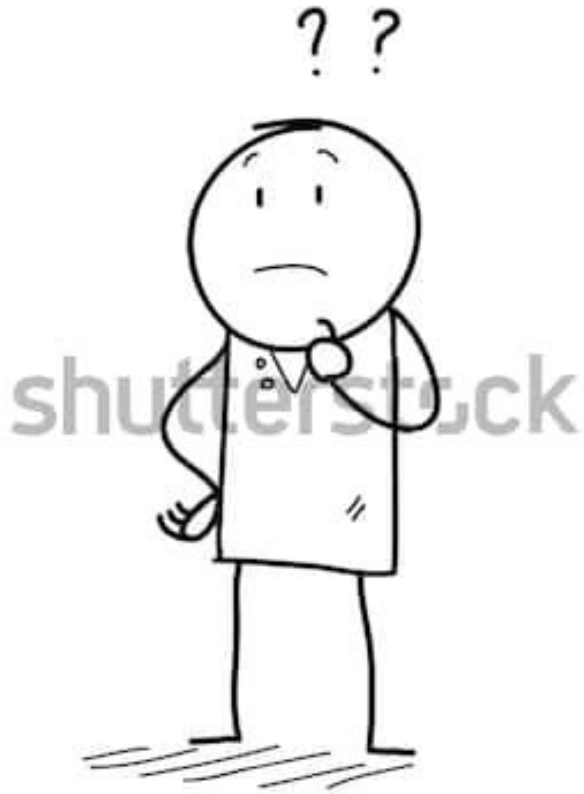
What are you thinking?

Image courtesy of: sodahead.com

How about here?

- Mark is a 67-year-old recently retired economist with a 35 year history of persistent back pain and fibromyalgia.
- Acute flare of symptoms three months ago
- Unable to walk without a cane, pain relief only while lying flat on his back
- Medications: baclofen, Meloxicam, Tylenol, Amitriptyline

Difficult client or difficult situation?



All Pain is Not Equal

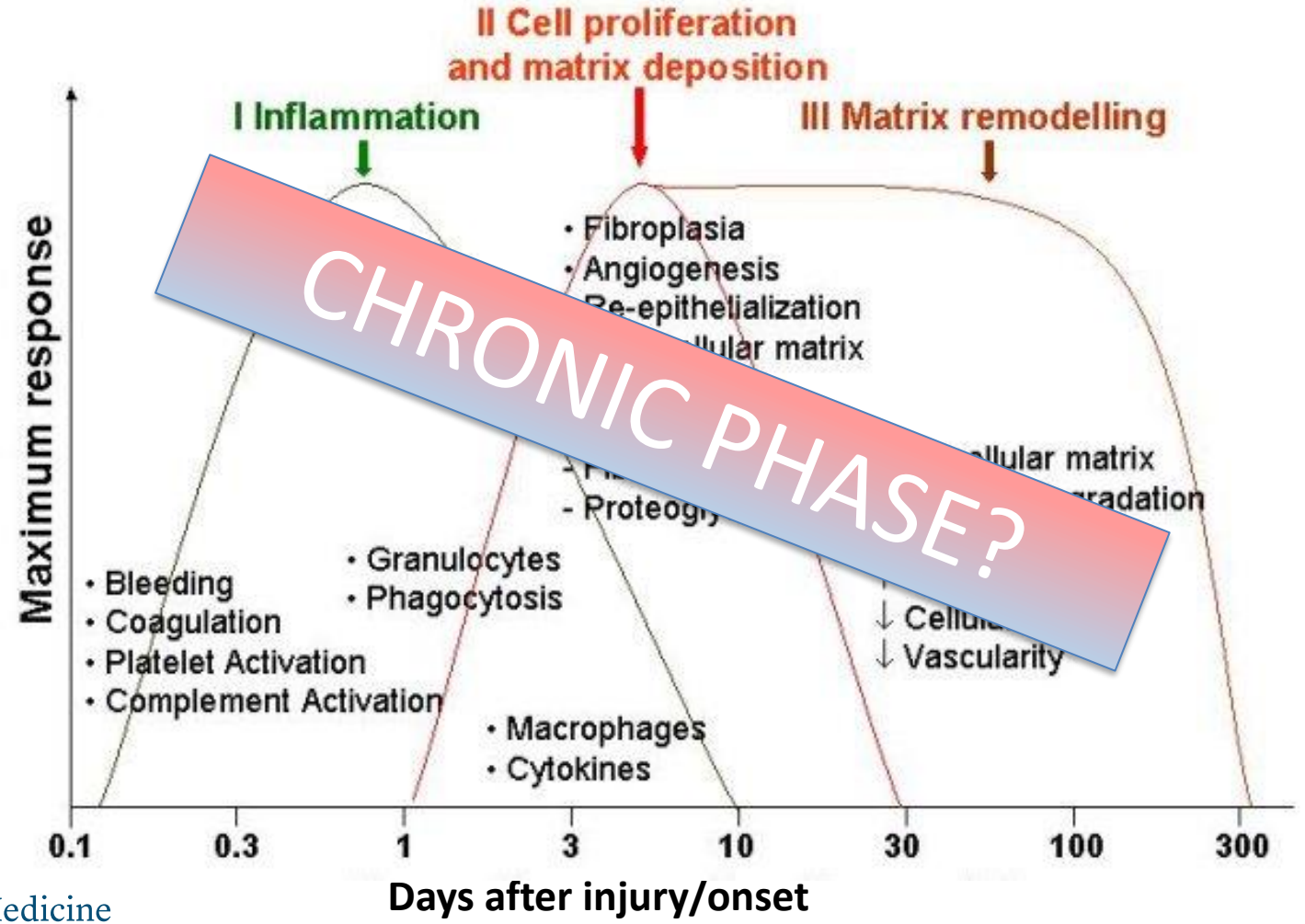
- "Pain is one of the most frequent causes for patients to seek medical care."
- ". . .**chronic pain is a leading source of human suffering and disability**."

Goldberg, D.S. & McGee, S.J., 2011
Mäntyselkä, P, & et al., 2001

What is Pain?

"An unpleasant **sensory** and **emotional** experience associated with **actual** or **potential** tissue damage, or described in terms of such damage." (International Association for the Study of Pain, 2018)

Stages of Tissue Healing



Pelogenix, Inc. (2018). https://www.pelogenix.com

Acute vs Persistent Pain

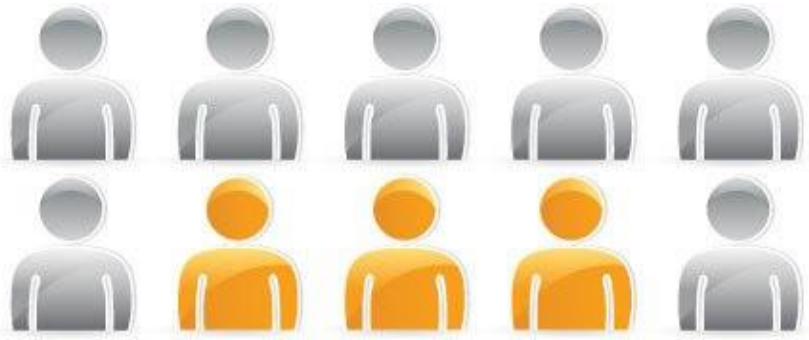
- Acute pain management:
  - Address the **underlying cause** **of pain**
- Persistent pain management:
  - Address the **effects** of pain and maximize **function** and **quality of life**

Persistent Pain State

"Pain without apparent biological value persisting beyond expected healing time"

Occurs in approximately

8-45% of population and 10-15% presenting to general practitioner



McQuay, H.J., Kalso, E., & Moore, R.A. (2008).

Imaging is Poorly Correlated with Pain

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%

n=3300 asymptomatic patients

Brinjikji, W., Luetmer, P., Comstock, B., Bresnahan, B., Chen, L., Deyo, R., & Jarvik, J. (2014).

Significant Public Health Issue

- Pain affects **100 million** Americans
- **50 million** report persistent daily pain
- **One in six people with persistent pain say the pain is sometimes so bad they want to die**

Nahin, R. L. (2015).
Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006).

Significant Socio-Economic Burden

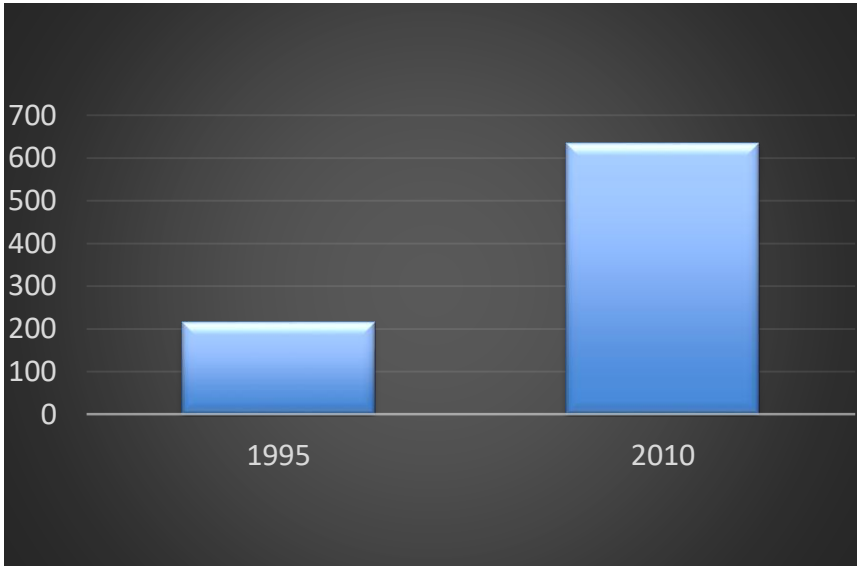
- **27% unable to maintain relationships** with friends and family
- **40%** say pain **impacts everyday activities**
- **20-50%** diagnosed with co-morbid **depression**
- **61% unable to work** outside the home
- **13-19%** have **lost** or **changed jobs**
- **40-60%** report **inadequate management** of their pain
- **88%** have other **chronic illnesses**
  - **Cardiovascular disease**
  - **Depression**

Breivik, H. (2011).
Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006).

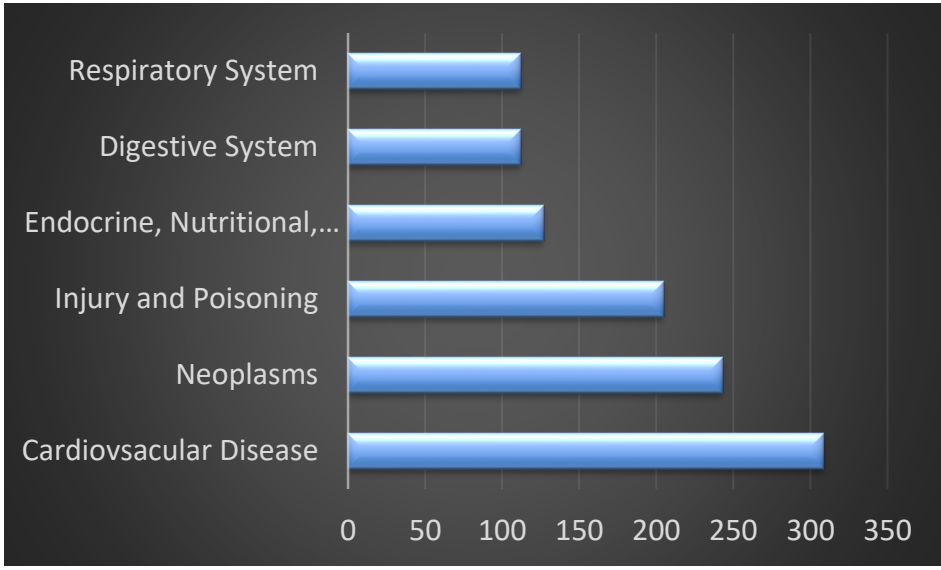
Significant Economic Burden

- Economic cost **$560-635 billion/year**

Chronic Musculoskeletal Pain



Economic Cost of Other Diagnoses



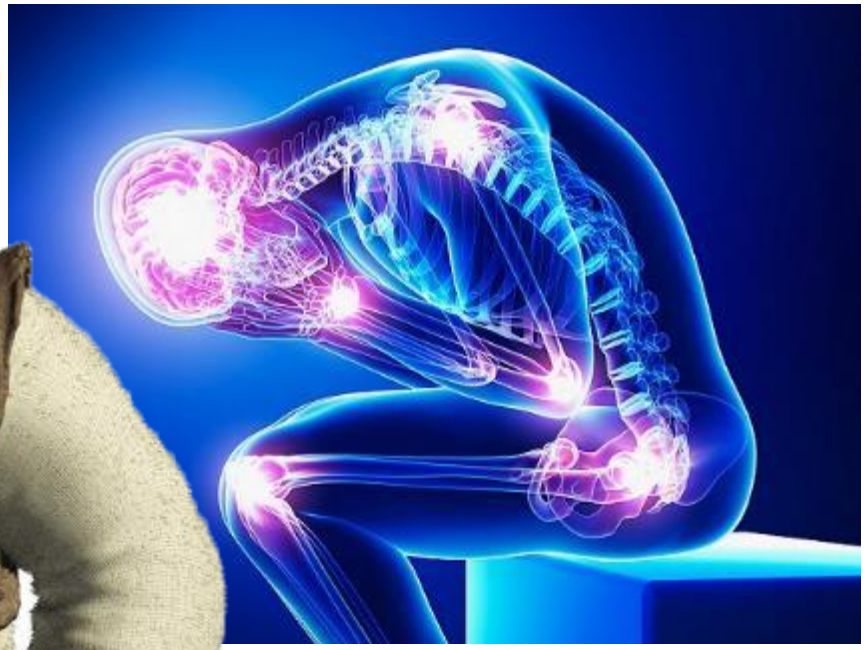
Gaskin, D. J., & Richard, P. (2012).

Persistent Pain & Mortality

Severe persistent pain is associated with an increased risk of mortality, independent of sociodemographic factors.

Torrance, N., Elliott, A. M., Lee, A. J., & Smith, B. H. (2010).

What Do They Have in Common?



https://www.sagaciousnewsnetwork.com/wp-content/uploads/2017/06/Chronic-Pain-Patients.jpg

http://pngimg.com/uploads/shrek/shrek_PNG18.png

What Do They Have in Common?

"Pain involves the intricate, variable interaction of

biological factors

(genetic, biochemical, etc),

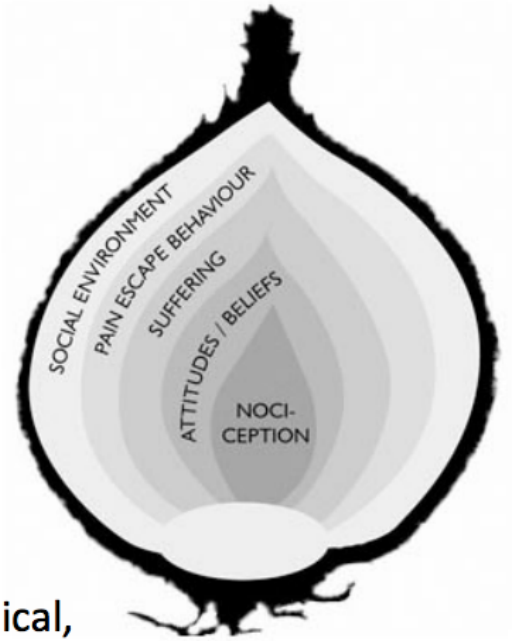
psychological factors

(mood, personality, behavior, etc)

and

social factors

(cultural, familial, socioeconomic, medical, etc)."



-George Engle – biopsychosocial definition of pain

Image: https://noinotes.files.wordpress.com/2010/12/noinotes_img_1008.jpg

Persistent Pain Has Wide-Reaching *Personal, Social, Psychological* Impacts!

Physical Functioning	Psychological Morbidity
• Inability to perform activities of daily living • Sleep disturbances • Fatigue	• Depression • Anxiety • Fear • Anger • Poor self-esteem • Maladaptive thoughts • Catastrophizing • Poor Self-Efficacy
Social Consequences	**Societal Consequences**
• Impaired relationships with friends and family • Intimacy/sexual activity • Social isolation	• Healthcare costs • Disability • Lost work

Turk, D. C., Fillingim, R. B., Ohrbach, R., & Patel, K. V. (2016).

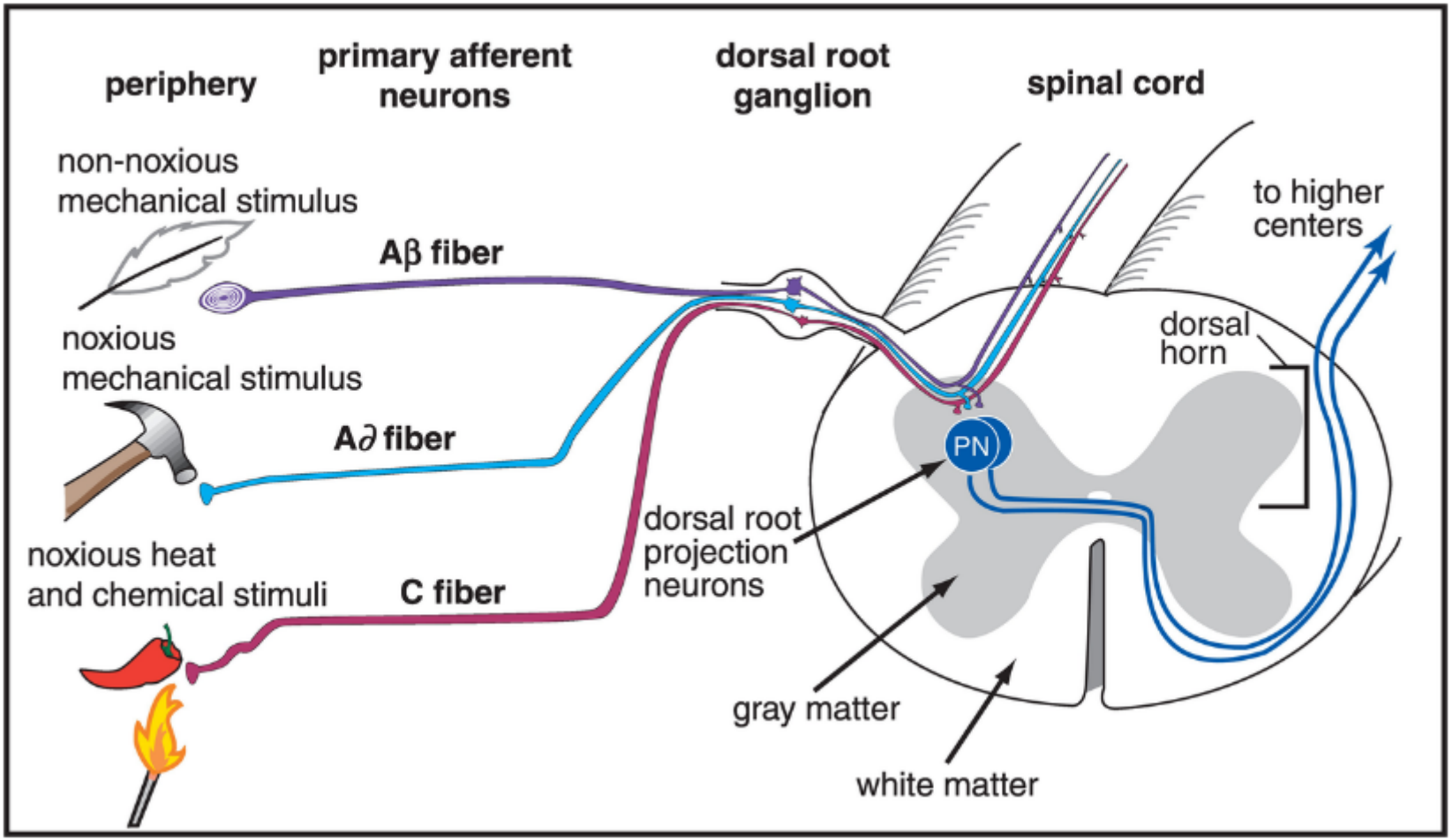
The Problem

- **Not all pain is equal**
- If persistent pain is different then so should:
  - Assessment
  - Management

Key Points About Pain

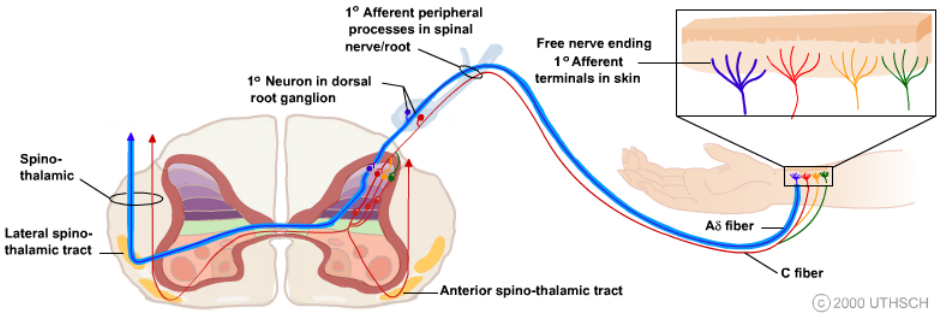
- There is more to pain than nociception:
  - Pain is a **FEELING**
  - Pain is always an **OUTPUT**
  - Pain is about **PROTECTION**, pain does not always equal harm
  - Pain is a **DECISION** your brain makes

Primary Afferent Neurons



https://nba.uth.tmc.edu/neuroscience/m/s2/chapter06.html

How is Nociception Transmitted to the Brain?



Detect signals of tissue damage or threat:

- Directly:
  - pressure, thermal
- Indirectly:
  - chemical

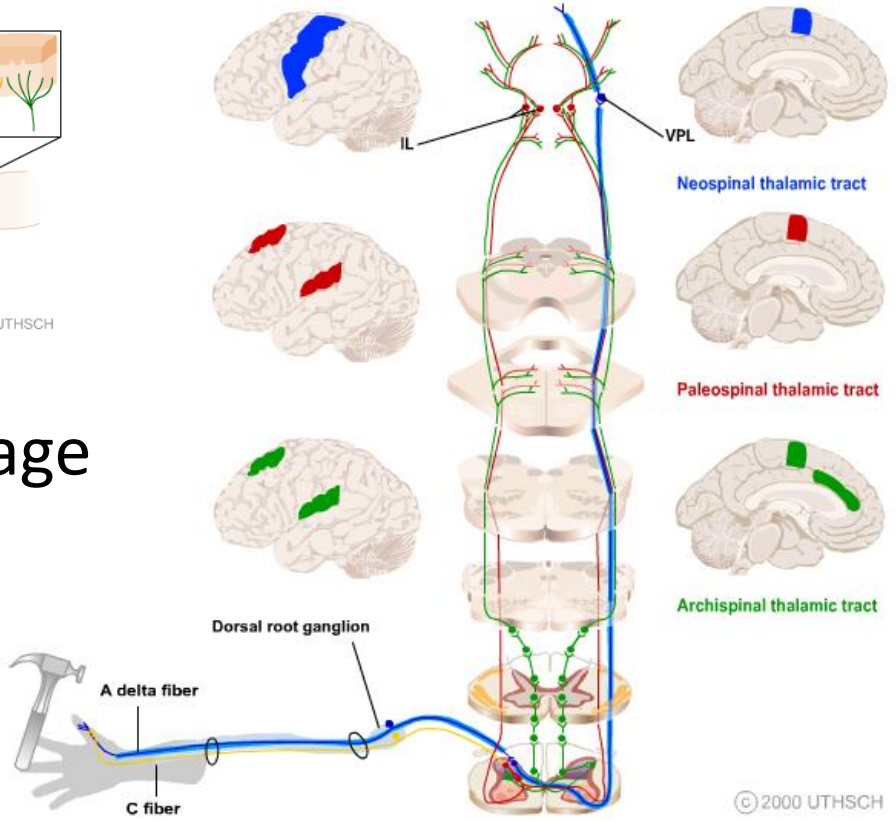
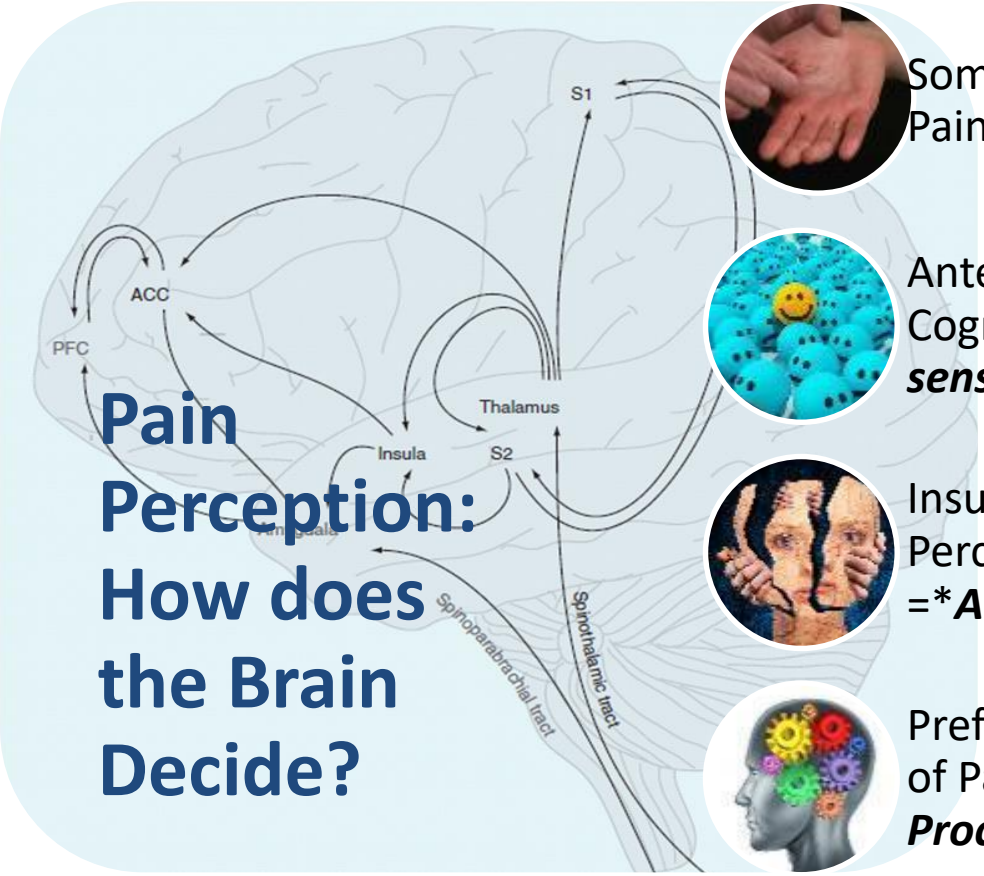


Figure 7.5
Summary of the three pathways carrying pain sensation.

https://nba.uth.tmc.edu/neuroscience/m/s2/chapter07.html

"Pain Relies on Context"



Pain Perception: How does the Brain Decide?

Somatosensory Cortex: Sensory discrimination, Pain intensity = ***More vague and diffuse pain***

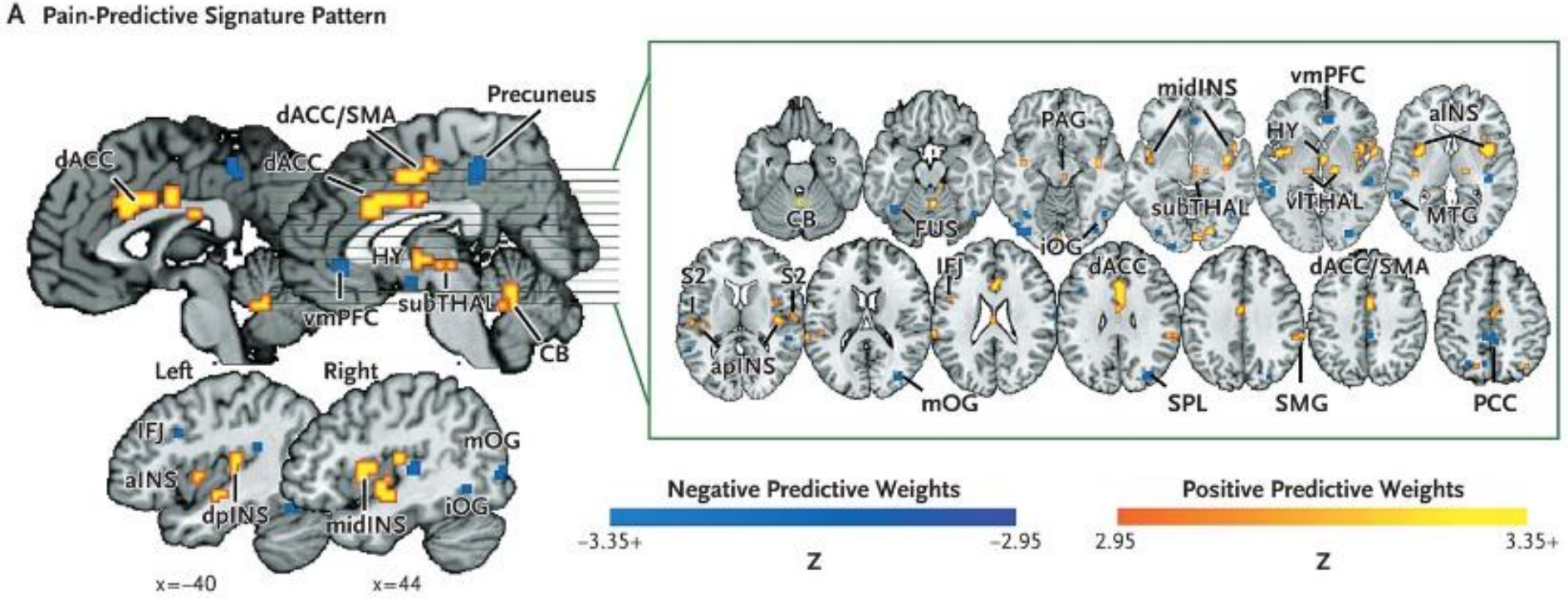
Anterior Cingulate Cortex: Emotional and Cognitive-Evaluation =***heightened pain sensation and > emotional aspect***

Insular Cortex: Sensory/Affective Perception "Suffering" =***Allodynia/Hyperalgesia***

Prefrontal Cortex: Cognitive Evaluation of Pain = ***Increased Emotional Processing***

An fMRI-Based Neurologic Signature of Physical Pain

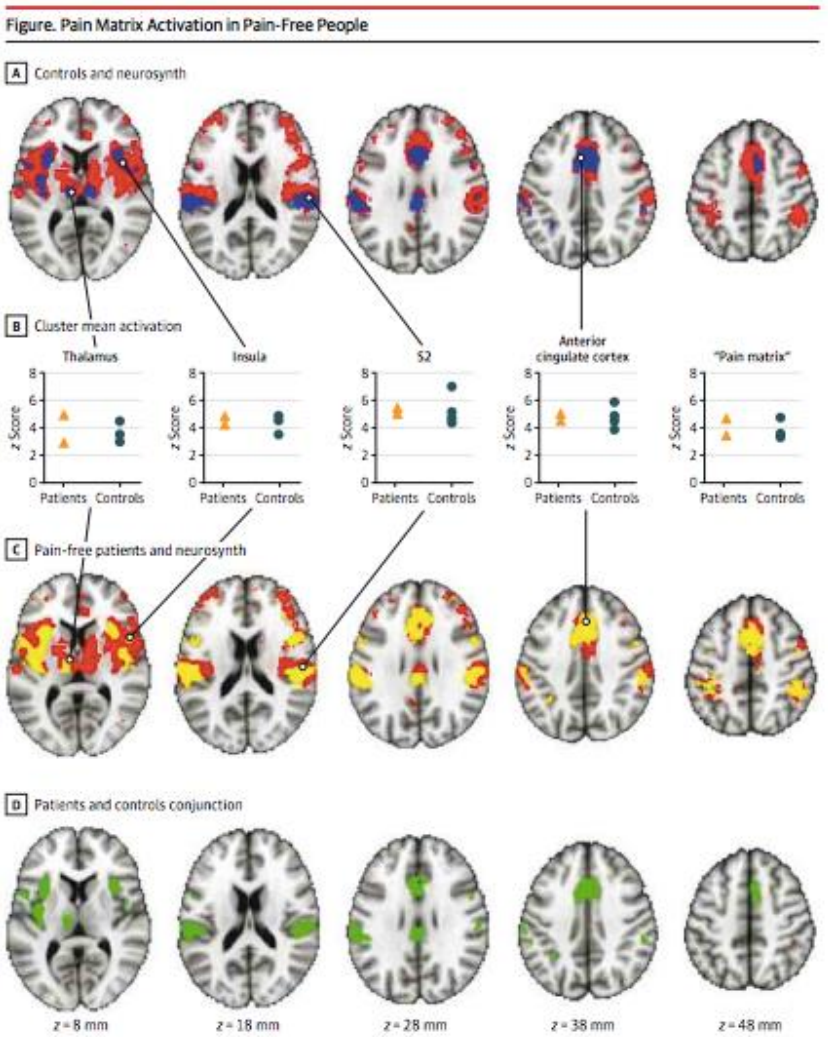
Tor D. Wager, Ph.D., Lauren Y. Atlas, Ph.D., Martin A. Lindquist, Ph.D., Mathieu Roy, Ph.D., Choong-Wan Woo, M.A., and Ethan Kross, Ph.D.



SEN & SP= 94%

Wager, T.D., Atlas, L.T., Lindquist, M.A., Roy, M., Woo, C., & Kross, E. (2013)

Pain Matrix



The "Pain Matrix" in Pain-Free Individuals

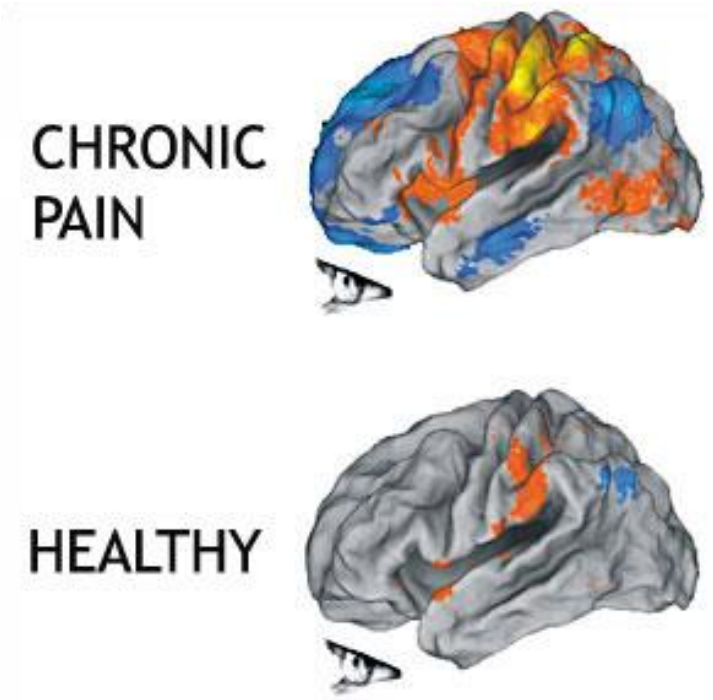
JAMA Neurology June 2016 Volume 73, Number 6

But What Happens When This Goes Awry?

- We know in some cases, the tissue has had adequate time to heal but the pain persists…
- Brain is convinced there is still a “threat”
- What’s the disconnect?

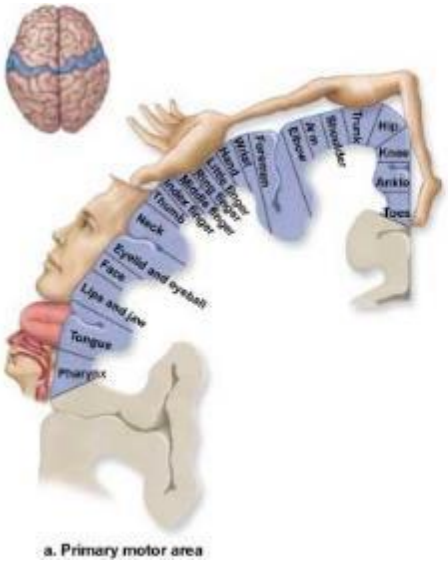
The Brain…

- Tries to help!!
  - Changes itself
    - Adds sensors (up-regulates) to the activation triggers making it easier to react
      - » You had a scary experience at a particular metro station in the dark…you will have unpleasant memories, maybe a physical reaction
    - The brain can also adapt in the motor and sensory cortices



https://medicalxpress.com/news/2008-02-chronic-pain-brain.html

Cortical Reorganization



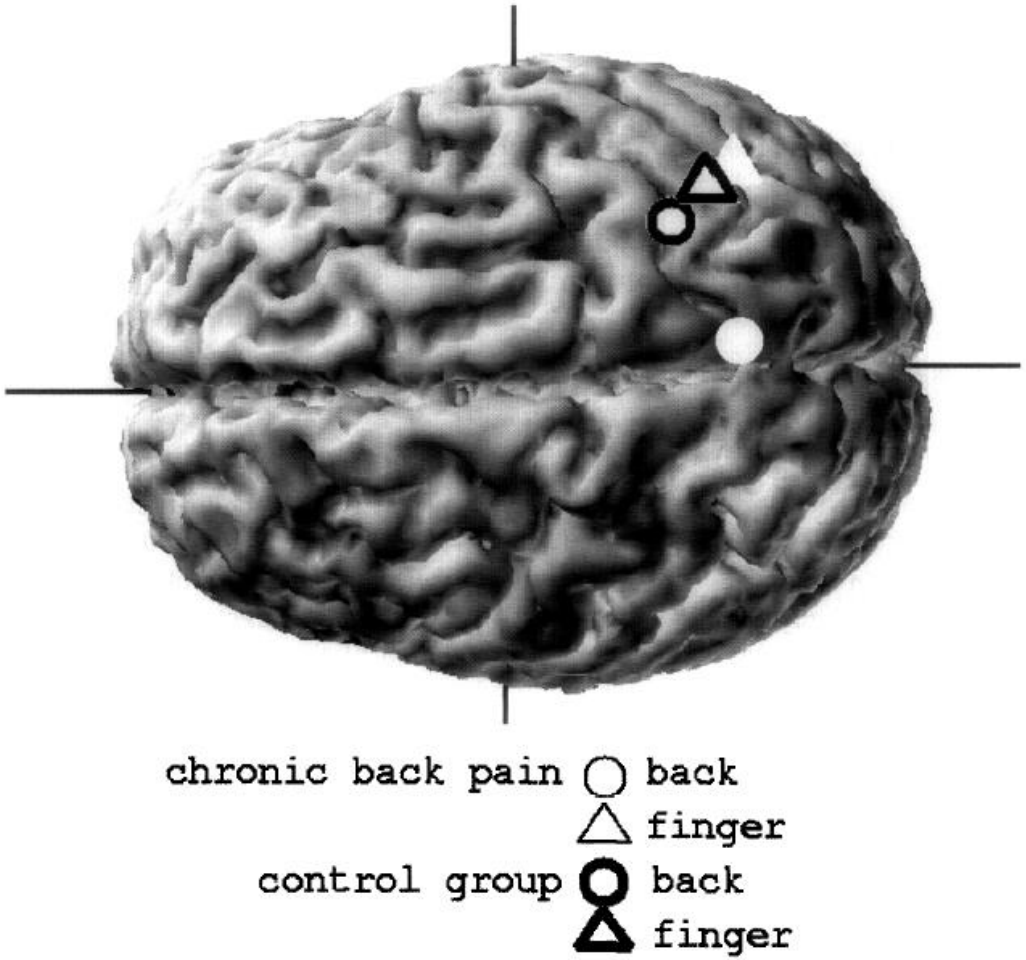
a. Primary motor area

b . Primary somatosensory area

SMUDGING IN THE VIRTUAL HAND

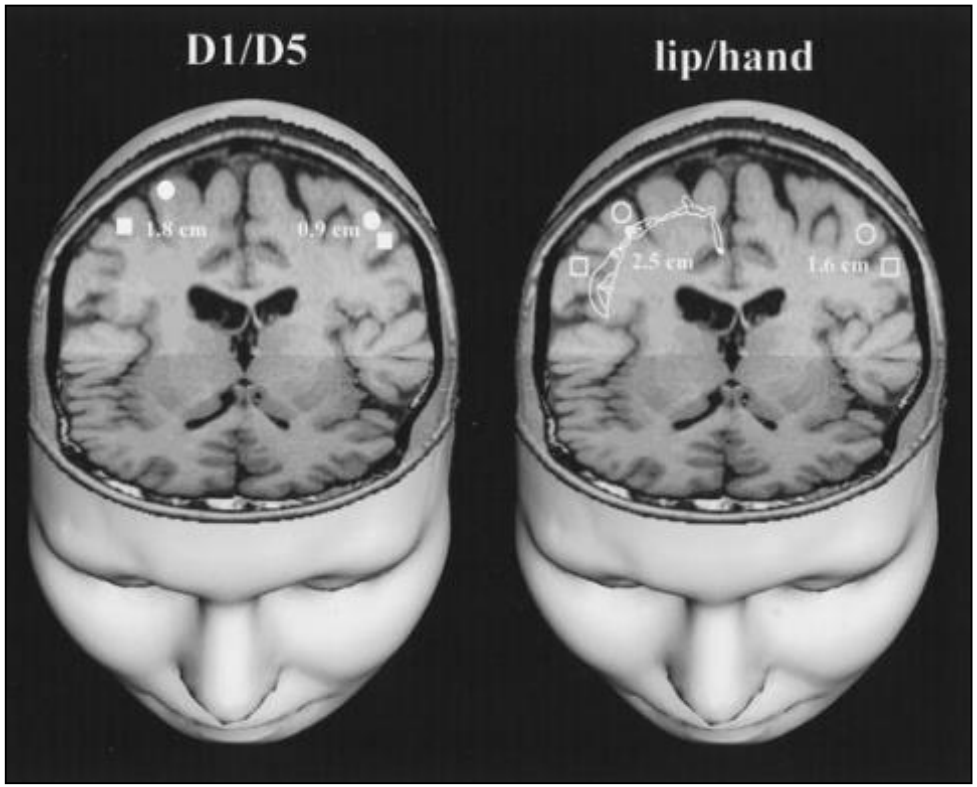
Butler, D.S. & Mosely, G.L. (2003).

Cortical Reorganization



Flor, H. (2000).

Cortical Reorganization



Patterns of cortical reorganization in complex regional pain syndrome.
Maihofner, Christian; Handwerker, Hermann; MD, PhD; Neundorfer, Bernhard; Birklein, Frank

Neurology. 61(12):1707-1715, December 23, 2003.
DOI: 10.1212/01.WNL.0000098939.02752.8E

Figure 4 . Left: Projection of the equivalent current dipole (ECD) localizations for D1 (filled square) and D5 (filled circle) onto individual MRI slices for one representative patient. Note the reduction in the cortical extension of the hand from 1.8 cm (unaffected side) to 0.9 cm (complex regional pain syndrome [CRPS] side). Right: Projection of the ECD for the center of the hand (open circle) and the lower lip (open square) onto individual MRI slices. Note the inferior and lateral shift of the hand position toward the lip on the CRPS side (distances between lip and hand 2.5 cm for the normal and 1.6 cm for the CRPS side).

Impaired Body Image and Tactile Discrimination

Pain 140 (2008) 239–243

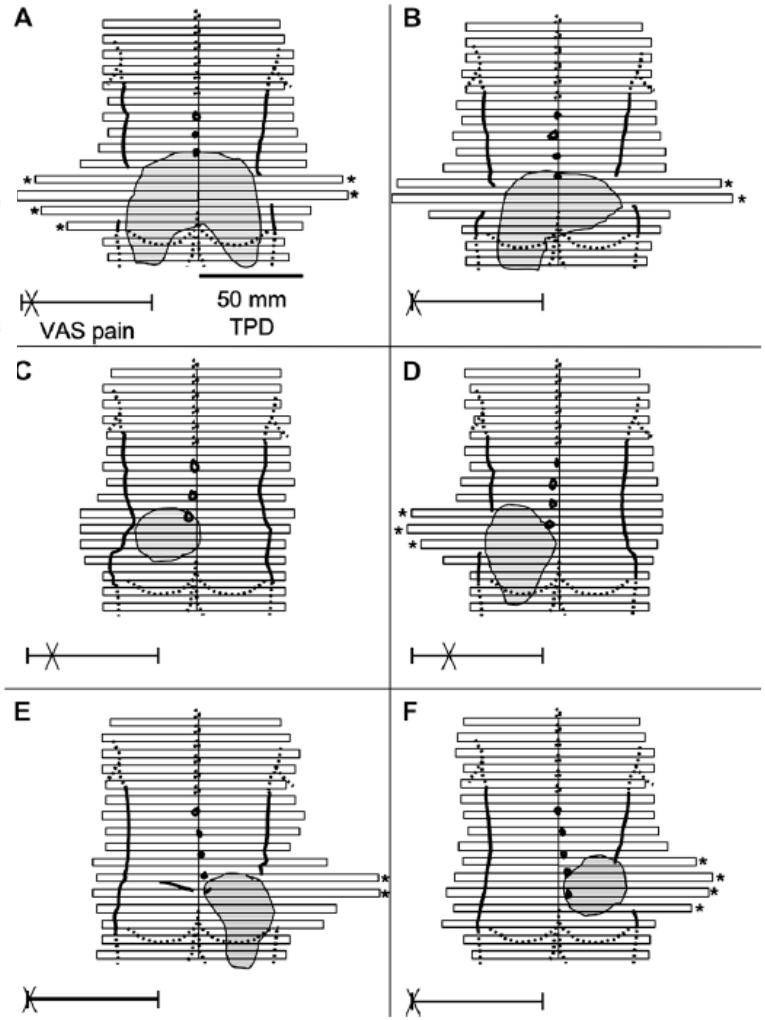
PAIN

www.elsevier.com/locate/pain

Clinical note

I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain

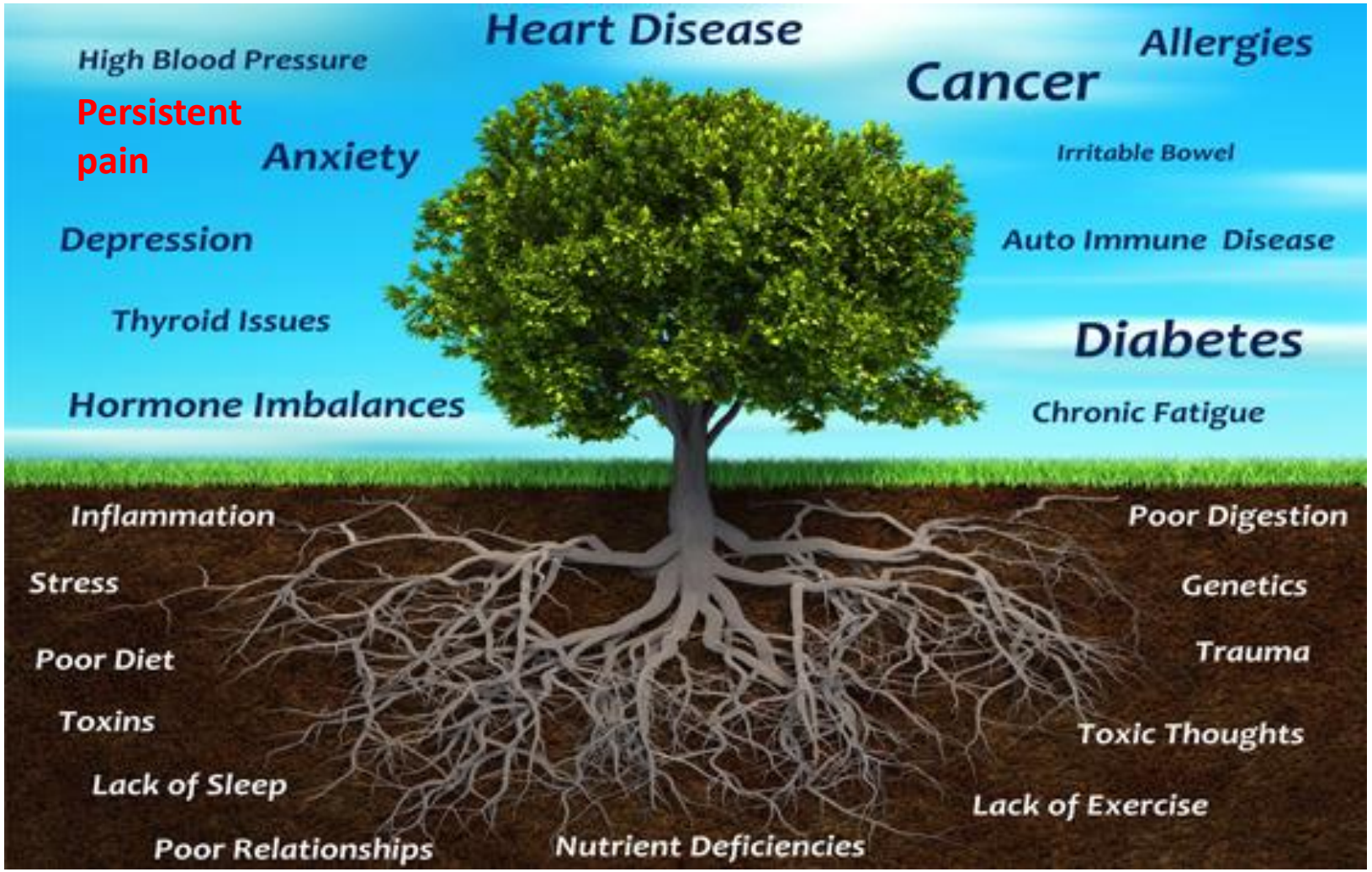
G. Lorimer Moseley *



Sensitization

Wand et. al., (2011) conclude that “it is likely that part of the pain experience of chronic low back pain patients is mediated by sensitivity changes within the central nervous system and the demonstrated brain changes are a probable contribution to this.“

The Root Cause of Disease. . .
What Do We Need to Assess?



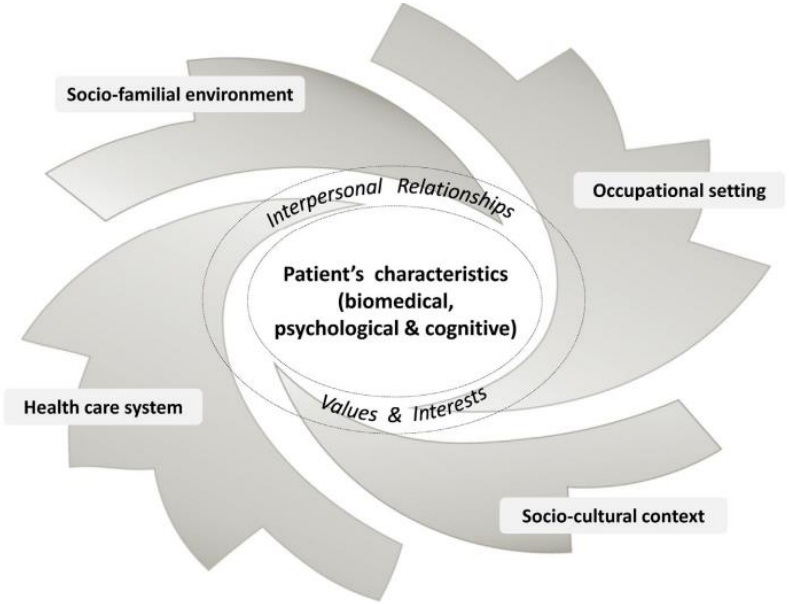
http://goldfunctionalwellness.com/wp-content/uploads/2013/10/The-Root-cause-FDN-tree.jpg

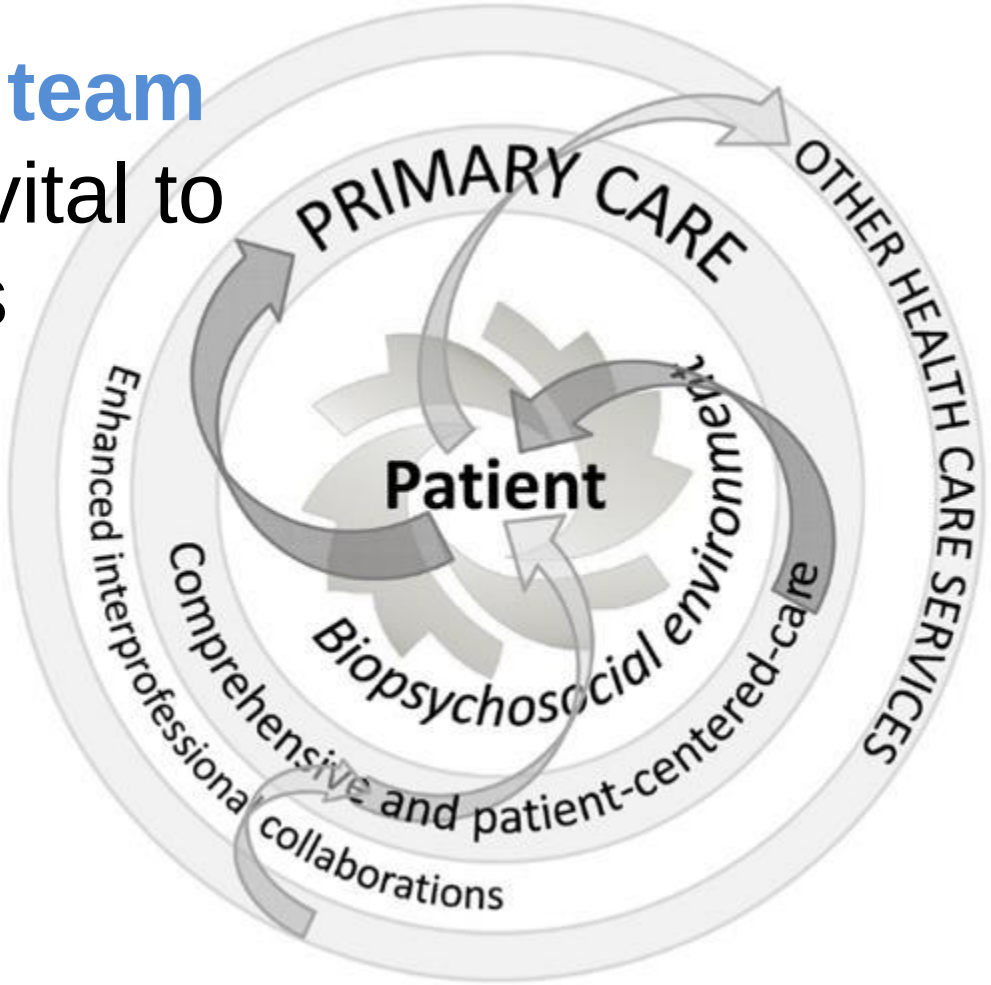
So What Do We Do?

Image courtesy of: https://blog.marketo.com/

The Tissue Is Not Just the Issue

- A **biopsychosocial, team based approach** is vital to successful outcomes





Ramond-Roquin, A., et. al. (2015).

Contributing/Risk Factors for Persistent Pain

- **Social factors**
  - Tenuous housing or employment status, low educational levels and family income, stress over housing, social isolation, history of physical or sexual abuse, past traumatic life events, cumulative traumatic life events
- **Physiological**
  - Advancing age, low activity levels, poor sleep quality, poor diet
- **Psychological**
  - Anxiety, depression, anger/hostility, impaired self-esteem, impaired general emotional functioning, negative pain beliefs

Courtney, C.A., Fernández-de-Las-Peñas, C., & Bond, S. (2017).
Casey, Y., Greenberg, A., Nicassio, M., Harpin, R., & Hubbard, R. (2008).
Hooten, W.M. (2016).

What Screening Tools Do We Have?

- Fear Avoidance Belief Questionnaire
- Pain Catastrophizing Scale
- **STarT Back Questionnaire**
- **Optimal Screening for Prediction of Referral and Outcome-Yellow Flag (OSPRO-YF)**
- **Patient Health Questionnaire - 4 (PHQ-4)**
- Pittsburgh Sleep Quality Index (PSQI)
- **One-Item Sleep Quality Scale (SQS)**

Image courtesy of: Pinterest.com

Fear Avoidance Beliefs Questionnaire

- **16 items**
- **5-10 minutes to administer**
- Fear-Avoidance (**work**): 0-42
  - Cut off score of 29 in working population
    - **Strong predictor of disability at 6 months**
  - Cut off score of 22 in non working population
- Fear-Avoidance (**physical activity**): 0-24
  - Cut off score of 14 = **poor treatment outcomes**

Pain Catastrophizing Scale

- **13 items**
- **5-10 minutes to administer**
- Three dimensions of pain catastrophizing:
  - Rumination
  - Magnification
  - Helplessness
- Higher score = greater evidence of pain catastrophizing
- Correlated with other health measures, including **pain intensity**, **pain-related disability**, **fear avoidance**, and **psychosocial distress**.

Why Screen for Catastrophizing?

- **Predictive of** onset of **back pain** and **disability**
- Surgical Patients:
  - predicts time to hospital discharge, postoperative pain severity, and poor quality of life, as well as the transition to chronic pain.
- Significant **predictor of pain-related disability** in chronic pain
- Worsens the pain experience

Turk, D. C., Fillingim, R. B., Ohrbach, R., & Patel, K. V. (2016).

STarT Back Screening Tool

- SBST is a simple prognostic questionnaire to **identify modifiable risk factors for back pain disability**
  - Biomedical
  - Psychological
  - Social
- The resulting score **stratifies patients** into:
  - Low Risk
  - Medium Risk
  - High Risk
- Each category has a **matched treatment proposal**

STarT Back Screening Tool

Thinking about the **last 2 weeks** tick your response to the following questions:

		Disagree 0	**Agree** 1
1	My back pain has **spread down my leg(s)** at some time in the last 2 weeks	☐	☐
2	I have had pain in the **shoulder** or **neck** at some time in the last 2 weeks	☐	☐
3	I have only **walked short distances** because of my back pain	☐	☐
4	In the last 2 weeks, I have **dressed more slowly** than usual because of back pain	☐	☐
5	It's not really safe for a person with a condition like mine to be physically active	☐	☐
6	**Worrying thoughts** have been going through my mind a lot of the time	☐	☐
7	I feel that **my back pain is terrible** and **it's never going to get any better**	☐	☐
8	In general I have **not enjoyed** all the things I used to enjoy	☐	☐

9. Overall, how **bothersome** has your back pain been in the **last 2 weeks**?

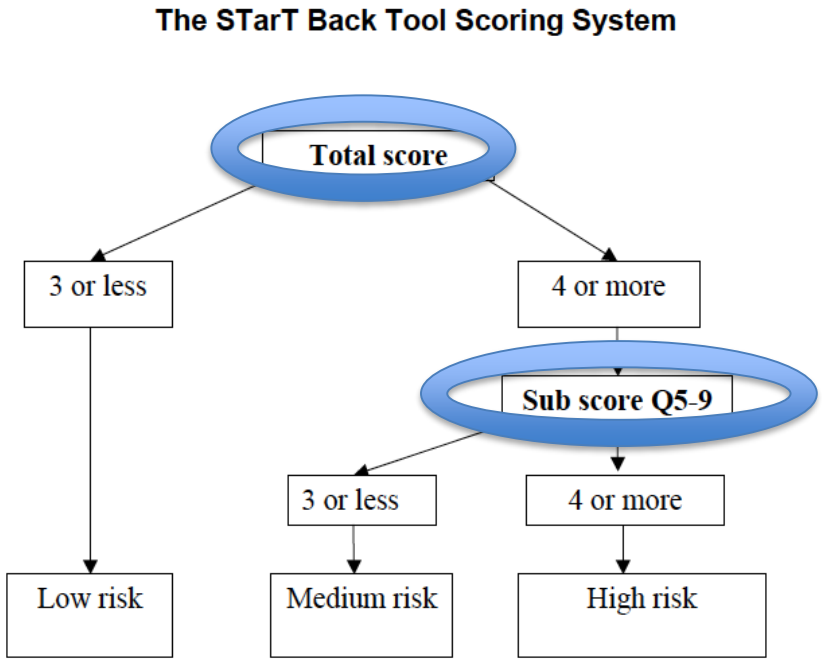
Not at all	Slightly	Moderately	Very much	Extremely
☐ 0	☐ 0	☐ 0	☐ 1	☐ 1

Total score (all 9): _____ **Sub Score (Q5-9):** _____

Funded by Arthritis Research UK

STarT Back Screening Tool

- SBST produces two scores:



nature.com

Funded by Arthritis Research UK

Low Risk

- The patients in the low risk category are very likely to improve. **Support and enable self-management**.
  - **Consultation with clinician**
  - **Assess medical issues, patient worries, concerns and social impact**
  - **Brief physical examination/assessment** helps with patient confidence
  - **Medication review** and advice
  - Address **specific patient issues** from the assessment
  - Seek to **encourage activity** and **self-management**
  - **Avoid unhelpful labels**
  - Provide **oral and written information**
  - Explain **outlook is good** but can re-consult if necessary

Medium Risk

- Main goals are to **restore function** (including work), **minimize disability** even if pain is unchanged and to support appropriate **self-management**.
  - **Elicit concerns** and adequate **physical examination**
  - **Treatments matched to physical findings** and specific needs and worries of the individual patient
  - Course of **physiotherapy**
    - **Specific physiotherapy interventions** when clear specific findings from physical assessment
    - **General functional activities** when no strong relationship between physical findings and back pain complaint
  - **Treatment objectives** should be **specific** and have an end time point and should 'translate' into **functional improvements** and **reduced disability**
  - Some patients will need onward **referral to specialist services** (i.e. secondary care spinal services, ortho, pain clinic)

High Risk

- The objectives are to **reduce pain**, **reduce disability** and **improve psychological functioning**.
  - physiotherapy using a combined **physical & cognitive-behavioral approach**
  - **Enable patients to manage** on-going and/or future episodes of low back pain
  - Specific focus on **cognitive, emotional and behavioral responses to pain** and their impact on function
  - **Identification of potential obstacles** to rehabilitation (e.g. Yellow & Blue Flags)

Screening for Anxiety & Depression

PHQ-4				
Over the last 2 weeks, how often have you been bothered by the following problems? *(Use "✔" to indicate your answer)*	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Little interest or pleasure in doing things	0	1	2	3
4. Feeling down, depressed, or hopeless	0	1	2	3

(For office coding: Total Score T___ = ___ + ___ + ___)

http://natap.org/2017/images/100317/100417-6/1004174.gif

- **Anxiety Subscale:** sum of items one and two
- **Depression subscale:** sum of items three and four
- A score of **three or greater** on either subscale is considered remarkable

Löwe, B., Wahl, I., Rose, M., et al. (2010).

The OSPRO-Yellow Flag Assessment Tool: Ten Psychological Questionnaires in One

CPAQ: Chronic Pain Acceptance Questionnaire

FABQ-PA: Fear-Avoidance Beliefs Questionnaire physical activity subscale

FABQ-W: Fear-Avoidance Beliefs Questionnaire work subscale

PASS-20: Pain Anxiety Symptoms Scale

PCS: Pain Catastrophizing Scale

PHQ-9: Patient Health Questionnaire-9

PSEQ: Pain Self-Efficacy Questionnaire

SER: Self-Efficacy for Rehabilitation

STAI: State-Trait Anxiety Inventory

STAXI: State-Trait Anger Expression Inventory

TSK-11: Tampa Scale of Kinesiophobia

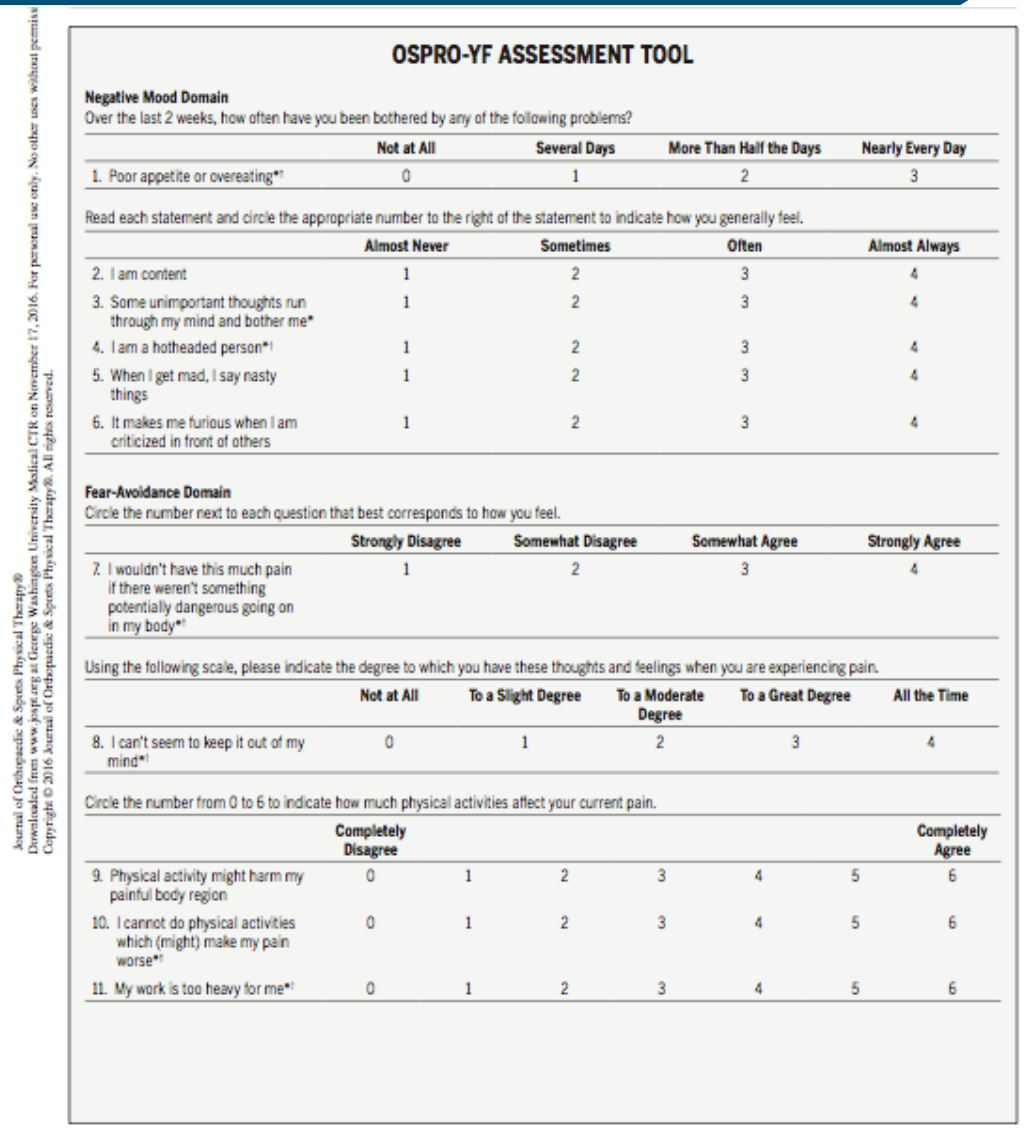
The OSPRO-Yellow Flag Assessment Tool

- The OSPRO-YF is a **concise yellow flag assessment tool** that allows for accurate estimates of individual, full-length psychological questionnaire scores for depressive symptoms, anxiety, anger, fear-avoidance beliefs, kinesiophobia, catastrophizing, self-efficacy, and pain acceptance.
- **Provides**:
  - **Full-length questionnaire score estimates**
  - **Identifies the presence of yellow flags**.
    - Scores that fall in the top quartile for negative psychological questionnaires (e.g. PCS, FABQ, PHQ-9) or bottom quartile for positive psychological questionnaires (e.g. PSEQ, CPAQ and SER).
- Three forms:
  - 17-items (85% accuracy)
  - 10-items (81% accuracy)
  - Seven-items (75% accuracy)
- The OSPRO-YF **informs treatment decision-making** and facilitates treatment monitoring

https://www.orthopt.org/content/s/yellow-flag-assessment-tool-about-the-tool

The OSPRO-Yellow Flag Assessment Tool

- [ORTHO PT Scoring Tool]
- https://www.orthopt.org/yf/



OSPRO-YF ASSESSMENT TOOL

Negative Mood Domain

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at All	Several Days	More Than Half the Days	Nearly Every Day
1. Poor appetite or overeating*†	0	1	2	3

Read each statement and circle the appropriate number to the right of the statement to indicate how you generally feel.

	Almost Never	Sometimes	Often	Almost Always
2. I am content	1	2	3	4
3. Some unimportant thoughts run through my mind and bother me*	1	2	3	4
4. I am a hotheaded person*†	1	2	3	4
5. When I get mad, I say nasty things	1	2	3	4
6. It makes me furious when I am criticized in front of others	1	2	3	4

Fear-Avoidance Domain

Circle the number next to each question that best corresponds to how you feel.

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
7. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body*†	1	2	3	4

Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

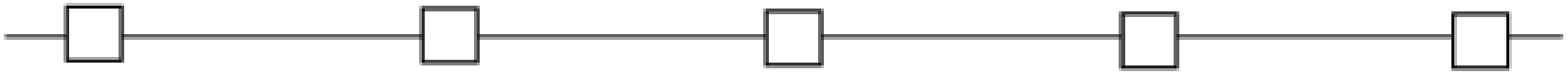
	Not at All	To a Slight Degree	To a Moderate Degree	To a Great Degree	All the Time
8. I can't seem to keep it out of my mind*†	0	1	2	3	4

Circle the number from 0 to 6 to indicate how much physical activities affect your current pain.

	Completely Disagree						Completely Agree
9. Physical activity might harm my painful body region	0	1	2	3	4	5	6
10. I cannot do physical activities which (might) make my pain worse*†	0	1	2	3	4	5	6
11. My work is too heavy for me*†	0	1	2	3	4	5	6

Screening for Psychological Stress

Stress refers to a situation where a person feels tense, restless, nervous, or anxious, or is unable to sleep at night because their mind is troubled all the time. Do you feel that kind of stress these days?



1	2	3	4	5
Not at all	Only a little	To some extent	Rather much	Very much

Elo, A.L., Leppänen, A., & Jahkola, A. (2003).

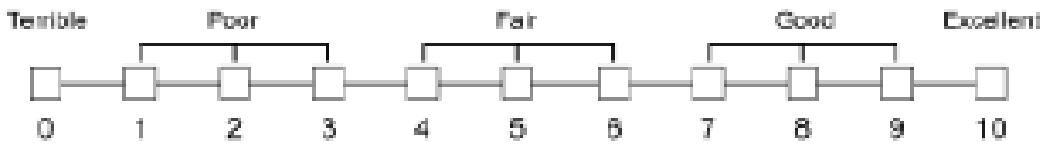
Screening for Sleep Quality

One-Item Sleep Quality Scale (SQS)

INSTRUCTIONS:

- *The following question refers to your overall sleep quality for the* ***majority*** *of nights in the* ***past 7 days ONLY****.*
- *Please think about the quality of your sleep* ***overall****, such as how many hours of sleep you got, how easily you fell asleep, how often you woke up during the night (except to go to the bathroom), how often you woke up earlier than you had to in the morning, and how refreshing your sleep was.*

1. During the **past 7 days**, how would you rate your sleep quality overall?
(Please mark only ***1*** *box)*



Snyder, E., Cai, B., DeMuro, C., Morrison, M.F., & Ball, W. (2018).

Screening for Sleep Quality

Name_____ Date_____

Sleep Quality Assessment (PSQI)

What is PSQI, and what is it measuring?

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. What time have you usually gotten up in the morning? _____
4. A. How many hours of actual sleep did you get at night? _____
   B. How many hours were you in bed? _____

5. During the past month, how often have you had trouble sleeping because you	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				
I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
9. During the past month, how would you rate your sleep quality overall?	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)

Scoring

Component 1	#9 Score	C1 _____
Component 2	#2 Score (<15min (0), 16-30min (1), 31-60 min (2), >60min (3)) + #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3)	C2 _____
Component 3	#4 Score (>7(0), 6-7 (1), 5-6 (2), <5 (3)	C3 _____
Component 4	(total # of hours asleep) / (total # of hours in bed) x 100 >85%=0, 75%-84%=!, 65%-74%=2, <65%=3	C4 _____
Component 5	# sum of scores 5b to 5j (0=0; 1-9=1; 10-18=2; 19-27=3)	C5 _____
Component 6	#6 Score	C6 _____
Component 7	#7 Score + #8 score (0=0; 1-2=1; 3-4=2; 5-6=3)	C7 _____

Add the seven component scores together _____ *Global PSQI* _____

A total score of "5" or greater is indicative of poor sleep quality.
If you scored "5" or more it is suggested that you discuss your sleep habits with a healthcare provider

- Pittsburgh Sleep Quality Index (PSQI)
  - Generally:
    - SEN 89.6%, SP 86.5% (kappa = 0.75, $p < 0.001$)

Buysse, D., Reynolds, C., Monk, T., Berman, S., & Kupfer, D. (1989). Mollayeva, T., Thurairajah, P., Burton, K., Mollayeva, S., Shapiro, C., & Colantonio, A. (2016, February)

Diet & Nutrition: What's on Your Plate?

Physical Activity: Are You Moving Enough?

Over the **past seven days**, on how many days have you done a total of **30 minutes or more of physical activity**, which was enough to raise your breathing rate? This may include sports, exercise, brisk walking or cycling for recreation or to get to and from places. This should not include housework or physical activity that may be part of your job.

Over the **past seven days**, on how many days have you performed **resistance training/ strengthening exercises** for each major muscle group?

Powell, K.E., King, A.C, Buchner, D.M., & et. al. (2018)

What is the Purpose of a Physical Exam?

https://www.slideteam.net/red-colored-tool-box-with-hammer-wrench-and-spanner-stock-photo.html

A Mechanism Base Approach?

Musculoskeletal Pain

Nociceptive Pain

Pain that arises from actual or threatened damage to non-neural tissue and is due to activation of nociceptors. (ISAP)

Nociceptive Pain

Clusters of symptoms and signs predictive of **Nociceptive Pain** in patients with low back pain with/without leg pain:

Presence of:

1. ***Pain localised to the area of injury/dysfunction (strongest predictor OR 69.79***
2. Clear, proportionate mechanical/anatomical nature to aggravating and easing factors
3. Usually intermittent and sharp with movement/mechanical provocation; may be a more constant dull ache or throb at rest

Absence of:

4. Pain in association with other dysesthesias (e.g. crawling, electrical, heaviness)
5. Pain variously described as burning, shooting, sharp or electric-sock-like
6. Night pain, distrubed sleep
7. Antalgic (i.e. pain relieving) postures/movement patterns

SEN: 90.0, SP: 91.0, LR+ 10, LR- 0.10

Neuropathic Pain

"Pain caused by a lesion or disease of the somatosensory nervous system." (IASP)

Neuropathic Pain

Clusters of symptoms and signs predictive of **Peripheral Neuropathic Pain** in **patients with low back pain with/without leg pain:**

Presence of:

1. History of nerve injury, pathology or mechanical compromise
2. ***Pain referred in a dermatomal or cutaneous distribution (strongest predictor OR 24.29)***
3. Pain/symptom provocation with mechanical/movement tests (e.g. active/passive, neurodynamic, i.e. SLR) that move/load/compress neural tissue

SEN: 86.3, SP: 96.0, LR+ 21.57, LR-0.14

Sensitization

"Increased responsiveness of nociceptive neurons to their normal input, and/or recruitment of a response to normally subthreshold inputs." (ISAP)

Peripheral Sensitization

"Increased responsiveness and reduced threshold of peripheral nociceptors to noxious stimuli in their receptive fields." (ISAP)

- Occurs in response to tissue injury, i.e. inflammation
- Protective mechanism, by definition – resolves as inflammation recedes and tissues heal

Central Sensitization

“Increased responsiveness of nociceptive neurons in the central nervous system to their normal or subthreshold afferent input.” (ISAP)

Central Sensitization

Clusters of symptoms and signs predictive of **Central Sensitisation** in patients with **low back pain with/without leg pain:**

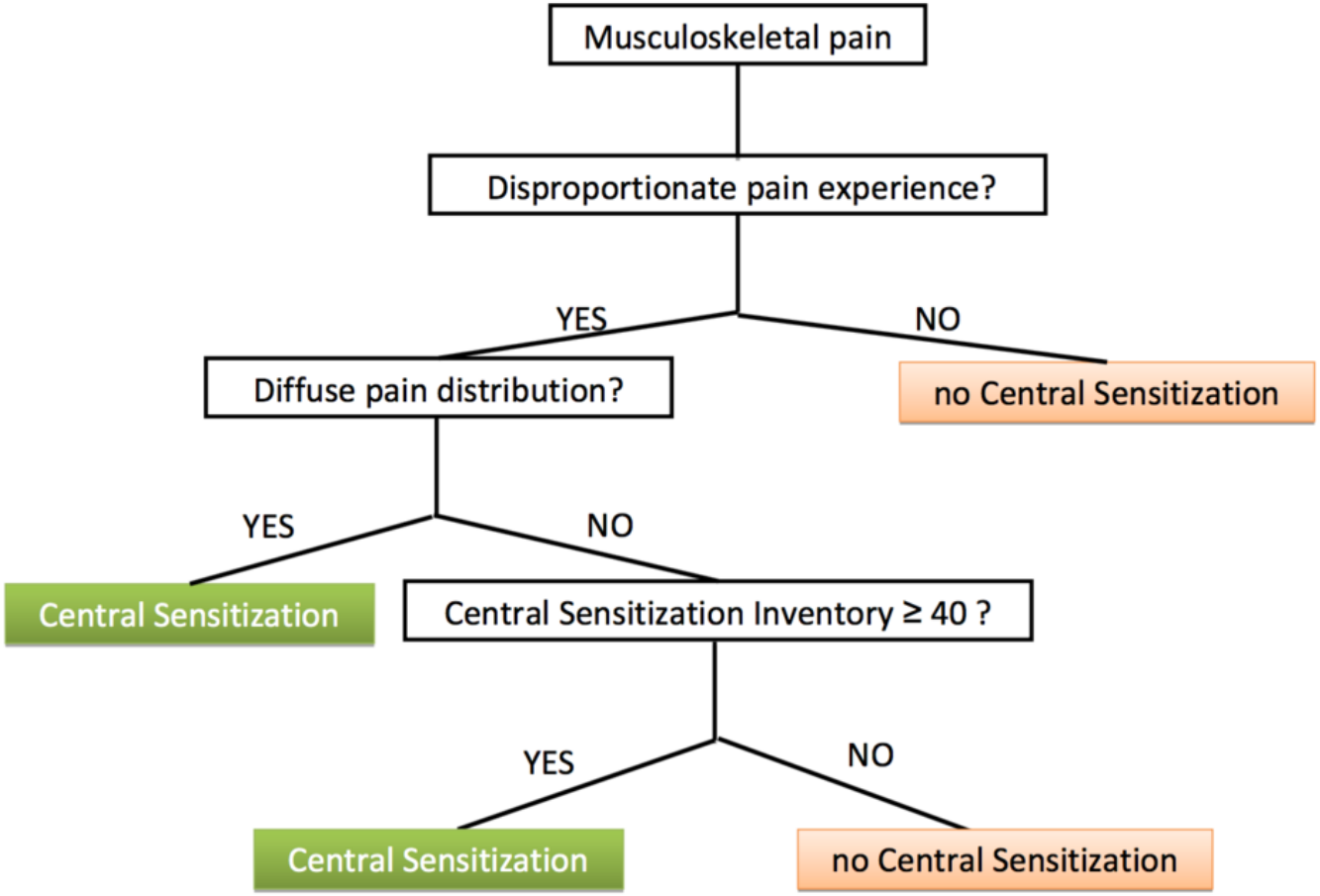
Presence of:

1. Pain disproportionate to the nature and extent of injury or pathology
2. ***Disproportionate, non-mechanical, unpredictable pattern of pain provocation in response to multiple/ nonspecific aggravating/easing factors (strongest predictor OR 30.69)***
3. Strong association with maladaptive psychosocial factors (e.g. negative emotions, poor self efficacy, maladaptive beliefs and pain behaviours, altered family/work/social life, medical conflict)
4. Diffuse/non-anatomic areas of pain/tenderness on palpation

SEN: 91.8, SP: 97.7, LR+ 40.64, LR- 0.08

Smart KM, et al. 2012

Central Sensitization?



Sensitivity 81%, Specificity 75%

Neblett, R., Cohen, H., Choi, Y., Hartzell, M.M., Williams, M., Mayer, T.G., & Gatchel, R.J. (2013).

Central Sensitization Inventory

CENTRAL SENSITIZATION INVENTORY: PART A

Name: Date:

Please circle the best response to the right of each statement.

1. I feel tired and unrefreshed when I wake from sleeping.	Never	Rarely	Sometimes	Often	Always
2. My muscles feel stiff and achy.	Never	Rarely	Sometimes	Often	Always
3. I have anxiety attacks.	Never	Rarely	Sometimes	Often	Always
4. I grind or clench my teeth.	Never	Rarely	Sometimes	Often	Always
5. I have problems with diarrhea and/or constipation.	Never	Rarely	Sometimes	Often	Always
6. I need help in performing my daily activities.	Never	Rarely	Sometimes	Often	Always
7. I am sensitive to bright lights.	Never	Rarely	Sometimes	Often	Always
8. I get tired very easily when I am physically active.	Never	Rarely	Sometimes	Often	Always
9. I feel pain all over my body.	Never	Rarely	Sometimes	Often	Always
10. I have headaches.	Never	Rarely	Sometimes	Often	Always
11. I feel discomfort in my bladder and/or burning when I urinate.	Never	Rarely	Sometimes	Often	Always
12. I do not sleep well.	Never	Rarely	Sometimes	Often	Always
13. I have difficulty concentrating.	Never	Rarely	Sometimes	Often	Always
14. I have skin problems such as dryness, itchiness, or rashes.	Never	Rarely	Sometimes	Often	Always
15. Stress makes my physical symptoms get worse.	Never	Rarely	Sometimes	Often	Always
16. I feel sad or depressed.	Never	Rarely	Sometimes	Often	Always
17. I have low energy.	Never	Rarely	Sometimes	Often	Always
18. I have muscle tension in my neck and shoulders.	Never	Rarely	Sometimes	Often	Always
19. I have pain in my jaw.	Never	Rarely	Sometimes	Often	Always
20. Certain smells, such as perfumes, make me feel dizzy and nauseated.	Never	Rarely	Sometimes	Often	Always
21. I have to urinate frequently.	Never	Rarely	Sometimes	Often	Always
22. My legs feel uncomfortable and restless when I am trying to go to sleep at night.	Never	Rarely	Sometimes	Often	Always
23. I have difficulty remembering things.	Never	Rarely	Sometimes	Often	Always
24. I suffered trauma as a child.	Never	Rarely	Sometimes	Often	Always
25. I have pain in my pelvic area.	Never	Rarely	Sometimes	Often	Always
				TOTAL:	

(subclinical= 0 to 20; mild = 30-39; moderate= 40-49; severe= 50-59; extreme= 60-100; Neblett R, et al. 2016)

Name: Date:

Have you been diagnosed by a doctor with any of the following disorders?

Please check the box to the right for each diagnosis and write the year of the diagnosis.

	NO	YES	Year Diagnosed
1. Restless Leg Syndrome			
2. Chronic Fatigue Syndrome			
3. Fibromyalgia			
4. Temporomandibular Joint Disorder (TMJ)			
5. Migraine or tension headaches			
6. Irritable Bowel Syndrome			
7. Multiple Chemical Sensitivities			
8. Neck Injury (including whiplash)			
9. Anxiety or Panic Attacks			
10. Depression			

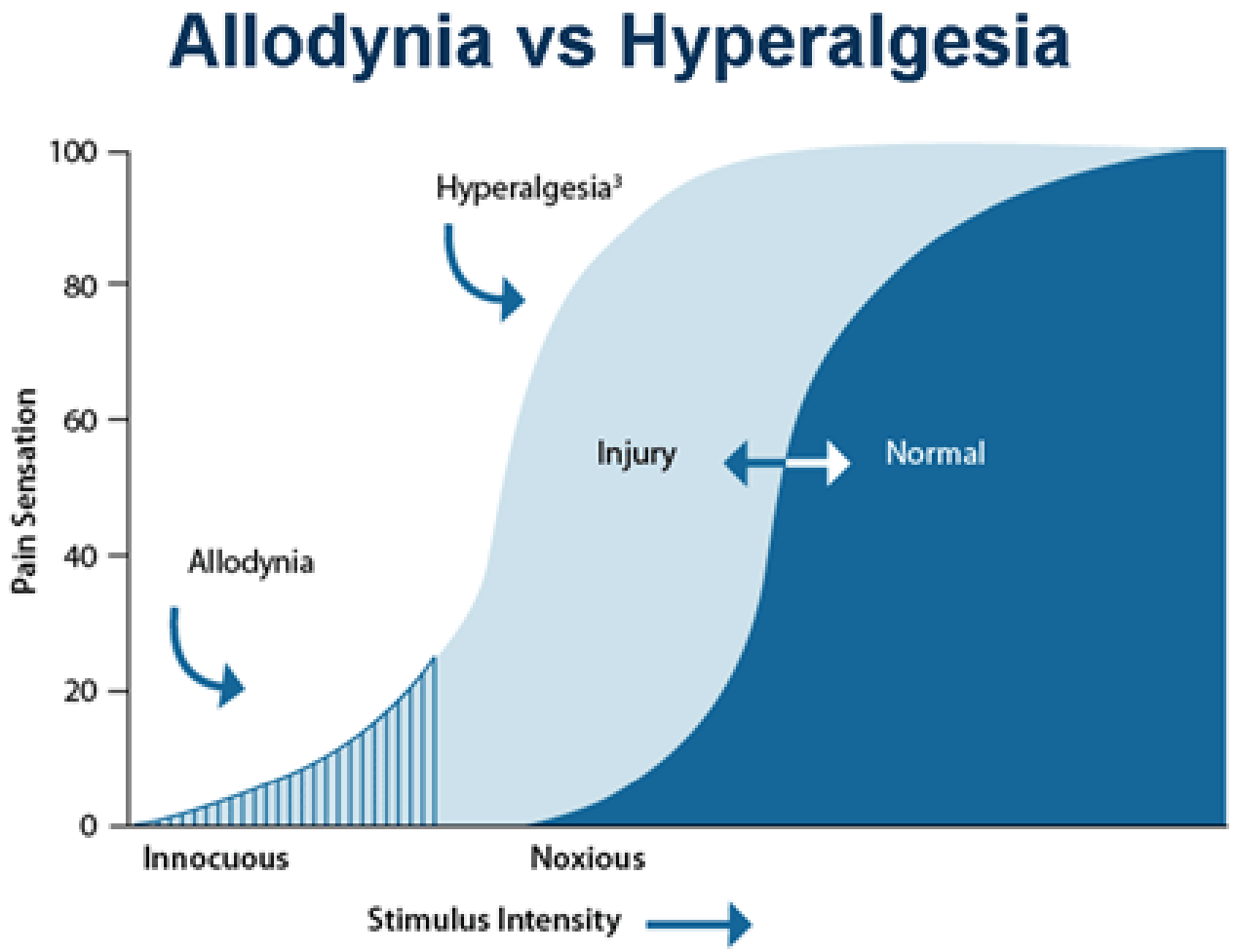
Extreme CSI severity levels are more likely to be associated with diagnoses of fibromyalgia, chronic fatigue syndrome, TMJ, tension/migraine headaches and anxiety or panic attacks ($p < 0.01$). Higher CSI severity levels are also associated with reported depressive symptoms, perceived disability, sleep disturbance and pain intensity ($p<0.02$).

Neblet R, et al. 2016

Nociplastic Pain

"Pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain." (ISAP)

Nociplastic Pain

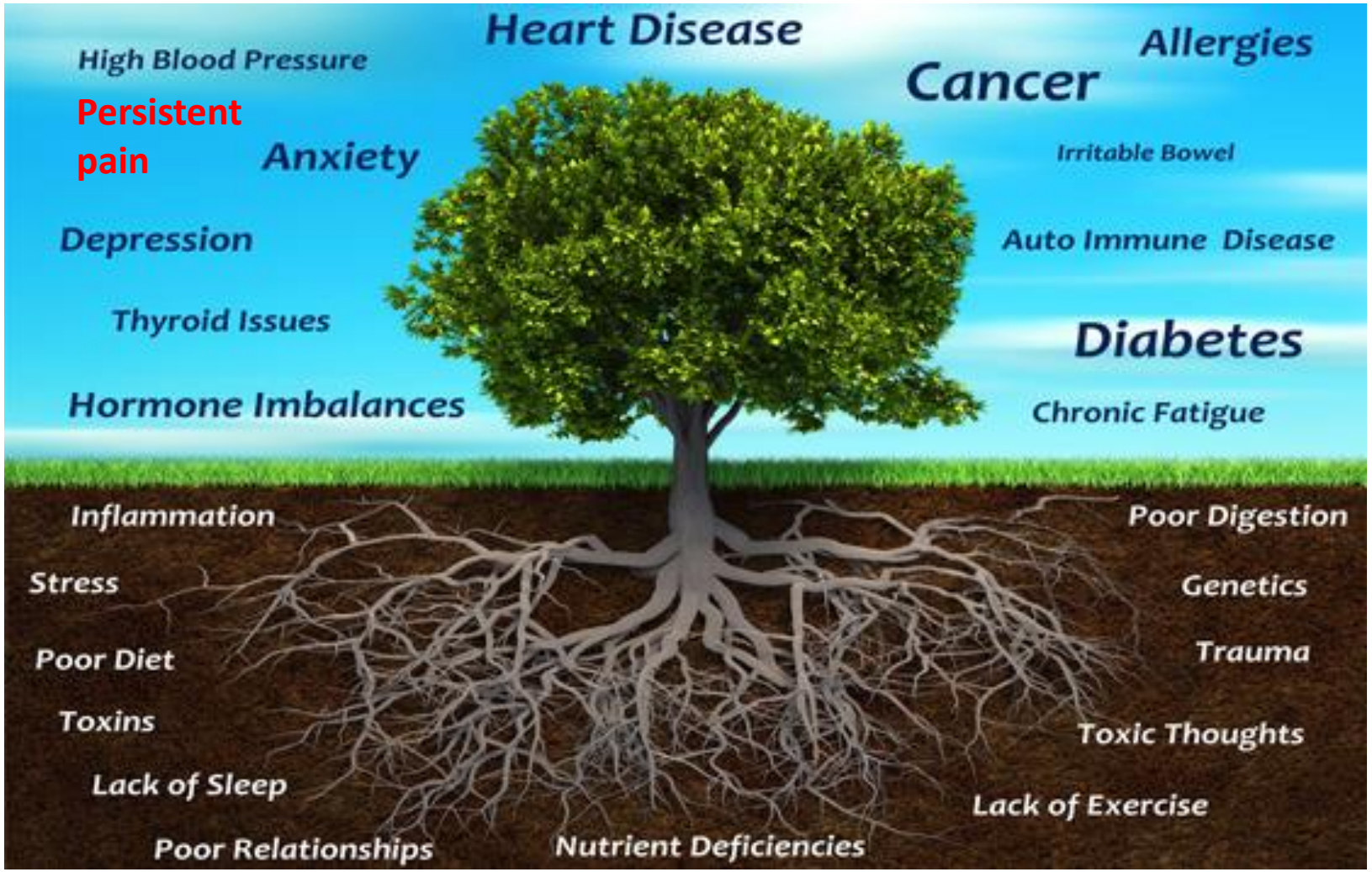


Additional Examination Tools

- Pain Pressure Threshold
- Scratch Test
- Pinch-Roll Test
- Match Stick Test
- Impaired Laterality
- Two Point Discrimination

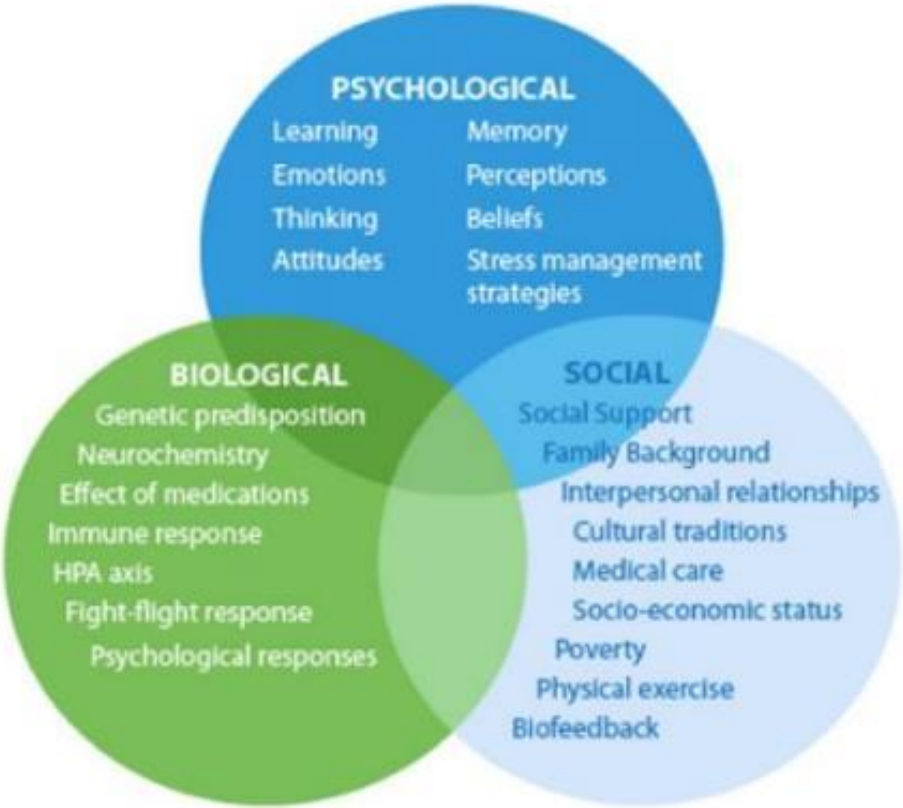
What Are You Currently Doing to Manage Persons with Persistent Pain? Could We Offer More?

The Root Cause of Disease. . .
What Changes Can We Make?



http://goldfunctionalwellness.com/wp-content/uploads/2013/10/The-Root-cause-FDN-tree.jpg

A Biopsychosocial Approach



Biopsychosocial model of pain

Championed by Butler and Moseley and others. 2000

Knowledge is Power

- Retrain Pain (retrainpain.org)

B **INTERVENTIONS – PATIENT EDUCATION AND COUNSELING**

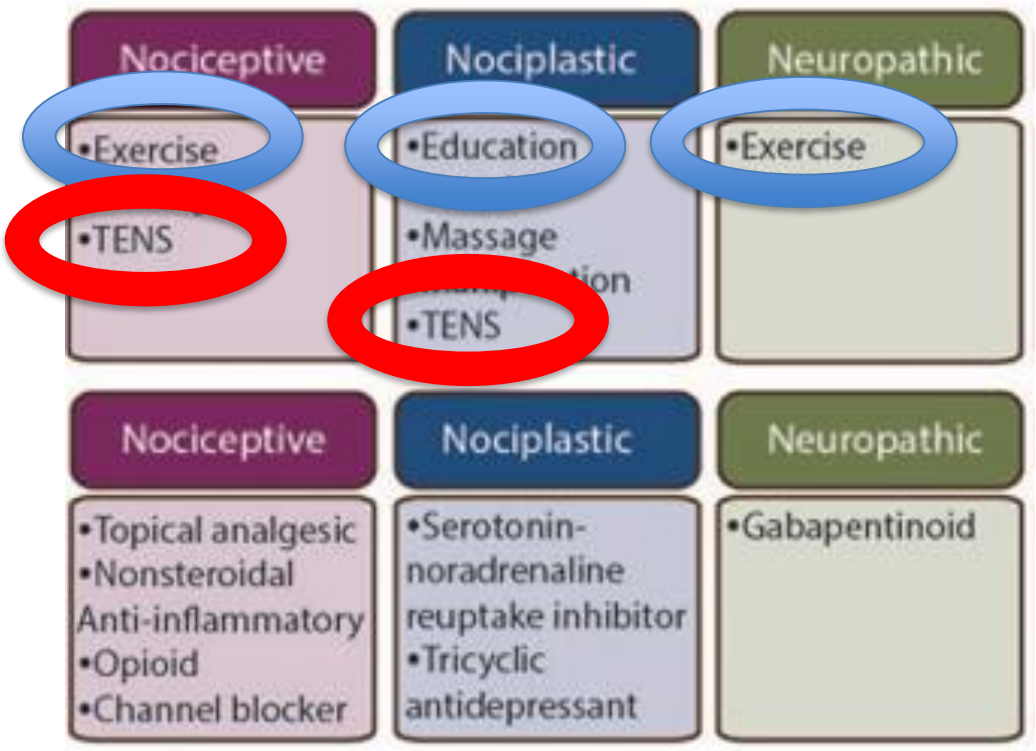
Clinicians should not utilize patient education and counseling strategies that either directly or indirectly increase the perceived threat or fear associated with low back pain, such as education and counseling strategies that (1) promote extended bed-rest or (2) provide in-depth, pathoanatomical explanations for the specific cause of the patient's low back pain. Patient education and counseling strategies for patients with low back pain should emphasize (1) the promotion of the understanding of the anatomical/structural strength inherent in the human spine, (2) the neuroscience that explains pain perception, (3) the overall favorable prognosis of low back pain, (4) the use of active pain coping strategies that decrease fear and catastrophizing, (5) the early resumption of normal or vocational activities, even when still experiencing pain, and (6) the importance of improvement in activity levels, not just pain relief.

https://eideticmemorytest.com/brain-exercises-free-training/

Delitto, A., George, S.Z., Van Dillen, L, Whitman, J.M., Sowa, Gwendolyn, Shekelle, P., Denninger, T.R. & Godges, J.J. (2012).

A Mechanism-Based Approach to Physical Therapist Management of Pain

Ruth L. Chimenti, Laura A. Frey-Law, Kathleen A. Sluka



Chimenti, R.L., Frey-Law, L.A., & Sluke, K.A. (2018).

Time out for TENS

Effectiveness of Transcutaneous Electrical Nerve Stimulation for Treatment of Hyperalgesia and Pain

Josimari M. DeSantana, PT, PhD, Deirdre M. Walsh, PT, PhD, Carol Vance, PT, MSc, Barbara A. Rakel, RN, PhD, and Kathleen A. Sluka, PT, PhD

- Low Frequency (< 10 Hz) or High Frequency (> 50Hz)
  - Low frequency not for those with opioid tolerance
  - High frequency for those with opioid tolerance
  - Otherwise, mixed within same session
- High Intensity
- Minimum 30 minutes

DeSantana, J.M., Walsh, D.M., Vance, C, Rakel, B.A. & Sluka, K.A. (2009).

Are They Moving Enough?

- **Insufficient physical activity** is an independent risk factor for disease; linked to over 35 different diseases.
- **Poor nutrition and/or inactivity** can independently modify **metaflammation**

Get Them Moving: The Power of Exercise

- Increased Cardiovascular Endurance and Capacity
- Enhance Muscular tone
- Increased Muscular Strength
- Improved Metabolism
- Decreased Adiposity
- **Improved Mood and Mental Health**
- Enhanced Memory and Cognitive Abilities
- **Immune-Modifying Properties**
- **Induced Analgesia**
  - **Released opioid peptides**

What Evidence Do We Have?

Low Back Pain

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2012;42(4):A1-A57. doi:10.2519/jospt.2012.0301

A **INTERVENTIONS – PROGRESSIVE ENDURANCE EXERCISE AND FITNESS ACTIVITIES**

Clinicians should consider (1) moderate- to high-intensity exercise for patients with chronic low back pain without generalized pain, and (2) incorporating progressive, low-intensity, submaximal fitness and endurance activities into the pain management and health promotion strategies for patients with chronic low back pain with generalized pain.

Delitto, A., & et. al. (2012).

What Evidence Do We Have?

Neck Pain: Revision 2017

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2017;47(7):A1-A83. doi:10.2519/jospt.2017.0302

Chronic

For patients with **chronic** neck pain with mobility deficits:

B Clinicians should provide a multimodal approach of the following:

- Thoracic manipulation and cervical manipulation or mobilization
- Mixed exercise for cervical/scapulothoracic regions: neuromuscular exercise (eg, coordination, proprioception, and postural training), stretching, strengthening, endurance training, aerobic conditioning, and cognitive affective elements
- Dry needling, laser, or intermittent mechanical/manual traction

C Clinicians may provide neck, shoulder girdle, and trunk endurance exercise approaches and patient education and counseling strategies that promote an active lifestyle and address cognitive and affective factors.

What Evidence Do We Have?

Chronic

For patients with **chronic** neck pain with radiating pain:

B Clinicians should provide mechanical intermittent cervical traction, combined with other interventions such as stretching and strengthening exercise plus cervical and thoracic mobilization/manipulation.

B Clinicians should provide education and counseling to encourage participation in occupational and exercise activities.

Chronic

For patients with **chronic** neck pain with headache:

B Clinicians should provide cervical or cervicothoracic manipulation or mobilizations combined with shoulder girdle and neck stretching, strengthening, and endurance exercise.

Chronic

For patients with **chronic** neck pain with movement coordination impairments (including WAD):

C Clinicians may provide the following:

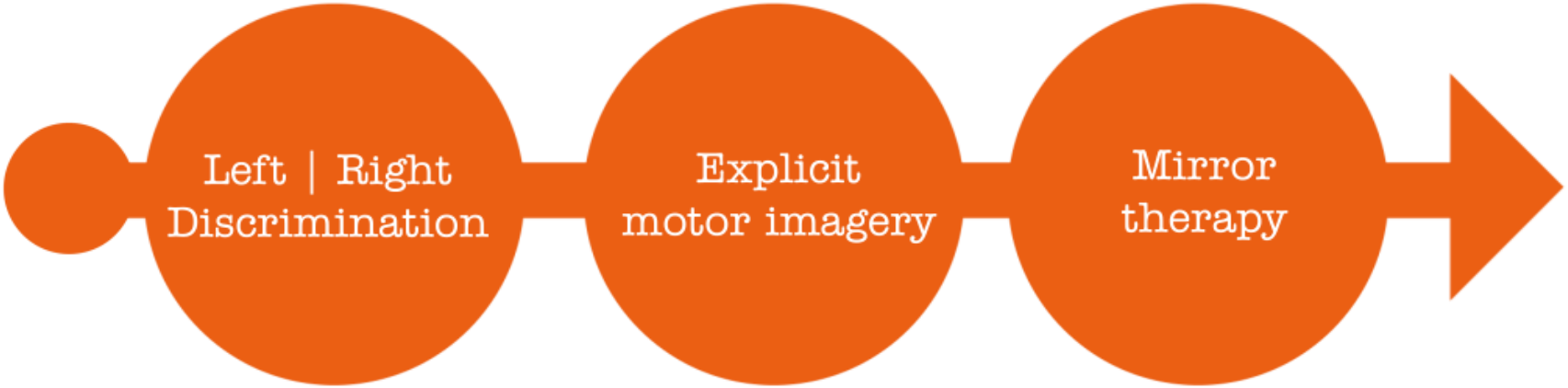
- Patient education and advice focusing on assurance, encouragement, prognosis, and pain management
- Mobilization combined with an individualized, progressive submaximal exercise program including cervicothoracic strengthening, endurance, flexibility, and coordination, using principles of cognitive behavioral therapy
- TENS

Neck Pain:
Revision 2017

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2017;47(7):A1-A83. doi:10.2519/jospt.20170302

Graded Motor Imagery: Where We Begin When Movement Is Too Painful

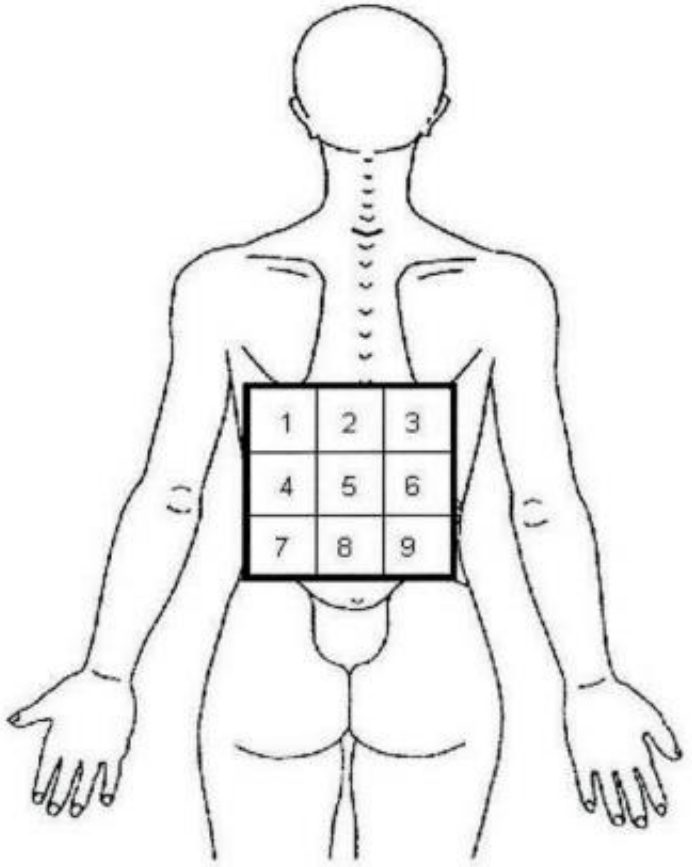


http://www.gradedmotorimagery.com/images/gmi-stages.gif

Bowering, K., & et. al. (2013).
Decety, J. (1996)
Flor, H., & et. Al. (2001)

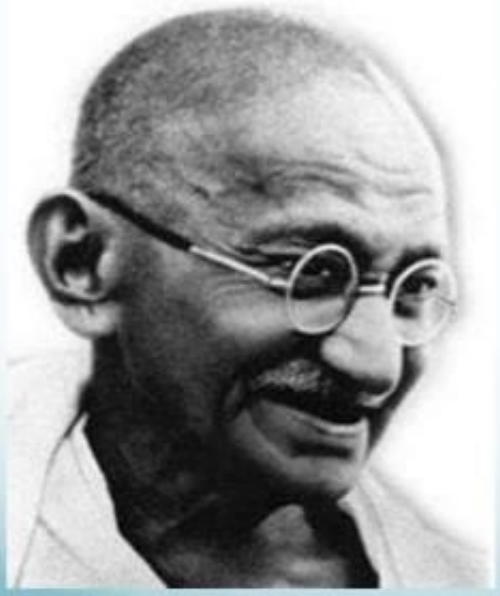
Sensory Discrimination

- Two-Point Discrimination
- Graphesthesia
- Localization
- Sharp/dull
- Directional
- Textures
- Ect.



Louw, A., & et al. (2015)
Harvie et al. (2017)

Change Thoughts & Beliefs



Your beliefs become your thoughts,
Your thoughts become your words,
Your words become your actions,
Your actions become your habits,
Your habits become your values,
Your values become your destiny.

M K Gandhi

https://www.quotemaster.org/belief+systems

Cognitive Behavioral Therapy

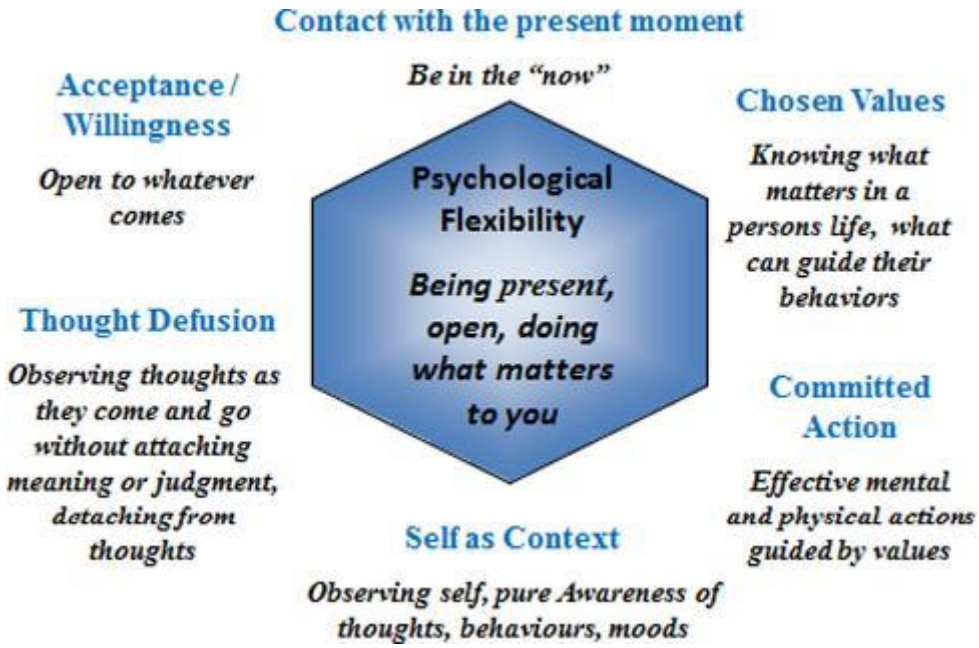
- Branch of psychotherapy (extensive research across mental health diagnoses)
- Hands-on therapy style that helps participants examine relationships between thoughts and feelings and behaviors
- Exploration of thinking behind various difficulties and look for errant thinking
- Goal directed to help individuals challenge assumptions and practice thinking differently to change outcomes

Clin J Pain. 2017 Jun;33(6):552-568. doi: 10.1097/AJP.0000000000000425.

Acceptance and Commitment Therapy (ACT) for Chronic Pain: A Systematic Review and Meta-Analyses.

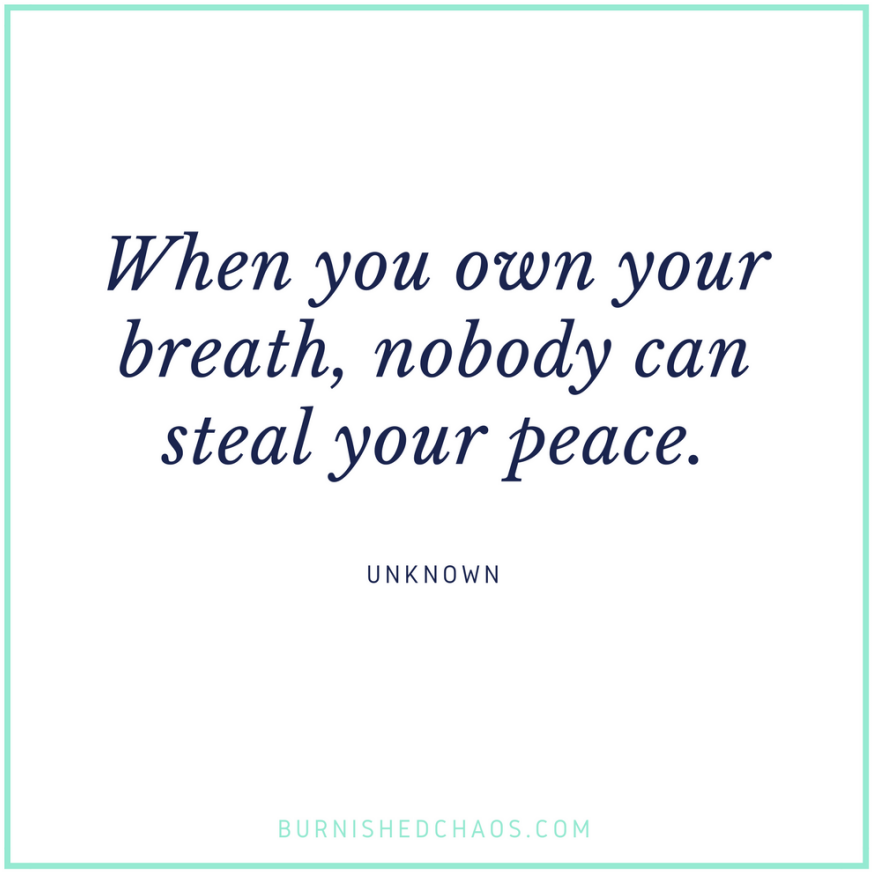
Hughes LS[1], Clark J, Colclough JA, Dale E, McMillan D.

- Process-based psychotherapy
- ACT teaches people to notice, accept and embrace private events instead of trying to control them.
- ACT does not attempt to improve or alleviate symptoms, but to stop obsessing over them, create new lifestyle patterns and make healthier choices.
- ACT works on the assumption that pain is part of being human and unavoidable
  - "Pain is inevitable but suffering is optional"



Hughes, L.S., Clark, J., Colclough, J.A., Dale, E., & McMillan, D. (2017).

How Do the Manage Stress?



Conscious Breath Exercise. . .
"You may need to exercise a nerve, to relax"

- Breathing activates afferent pathways that stimulate the vagus nerve
- Voluntary change in breath pattern can alter vagus nerve activity (Philippot P. & Blairy S. 2010)
  - Pursed lip breathing
  - Pranayama
    - Activate parasympathetic nervous system
      - Decreased DBP, SBP and anxiety & stress
      - **As little as 5 min/day in one week**
      - Improve oxidative stress
    - Enhance respiratory function
      - Increased oxygenation
    - Improved attention, reaction time, fine-motor function

https://www.pinterest.com/pin/664985319711657 32/

Mindfulness Meditation

- Mindfulness–Based Stress Reduction (MBSR) initiated by Jon Kabat-Zinn at University of Massachusetts
  - Over 100 randomized control trial (RCTs) have examined MBSR and mindfulness meditation on a variety of clinical and personal challenges
    - Large Effects:
      - **Stress**
    - Moderate Effects
      - **Anxiety**
      - **Depression**
      - **Distress**
      - **Quality of life**
    - Small Effects
      - **Burnout**

Khoury, B., Sharma, M., Rush, S.E., & Fournier, C. (2015).

What is Mindfulness

- "The awareness that emerges through **paying attention on purpose**, in the present moment, and **nonjudgmentally** to the unfolding experience moment by moment."
  - Formal Meditation
  - Informal focus on bringing attention and awareness to all aspects of life

McConville, J., McAleer, R., & Hahne, A. (2017).

A Good Night Sleep Really Does Matter

- Together with inactivity, **inadequate sleep** is one of the most underrated lifestyle risk factors for **chronic disease** and **inflammation**.

Can Poor Sleep Cause Pain and/or Inflammation?

- Sleep disturbance and long sleep duration are associated with **increases in markers of systemic inflammation** (increased CRP, IL-6)
- A single night of disrupted sleep can induce generalized **hyperalgesia** and increase **anxiety**.
- Poor sleep can contribute to and sustains **central sensitization** in patients with chronic low back pain
- Insomnia = **cerebral microglia** mediated **low-grade inflammatory** response
  - Increased IL-6
  - Prostaglandin E2
  - Nitric Oxide

Haack, M., Sanchez, E. & Mullington, J.M. (2007).
Irwin, M.R., Olmstead, R. & Carroll, J.E. (2015).
Staffe, A.T. Bech, M.W., Clemmensen, S.L., Nielsen, H.T., Larsen, D.B., Peterson, K.K. (2019).
Schuh-Hofer, S., & et.al. (2013).
Nijs, J., & et.al. (2017).

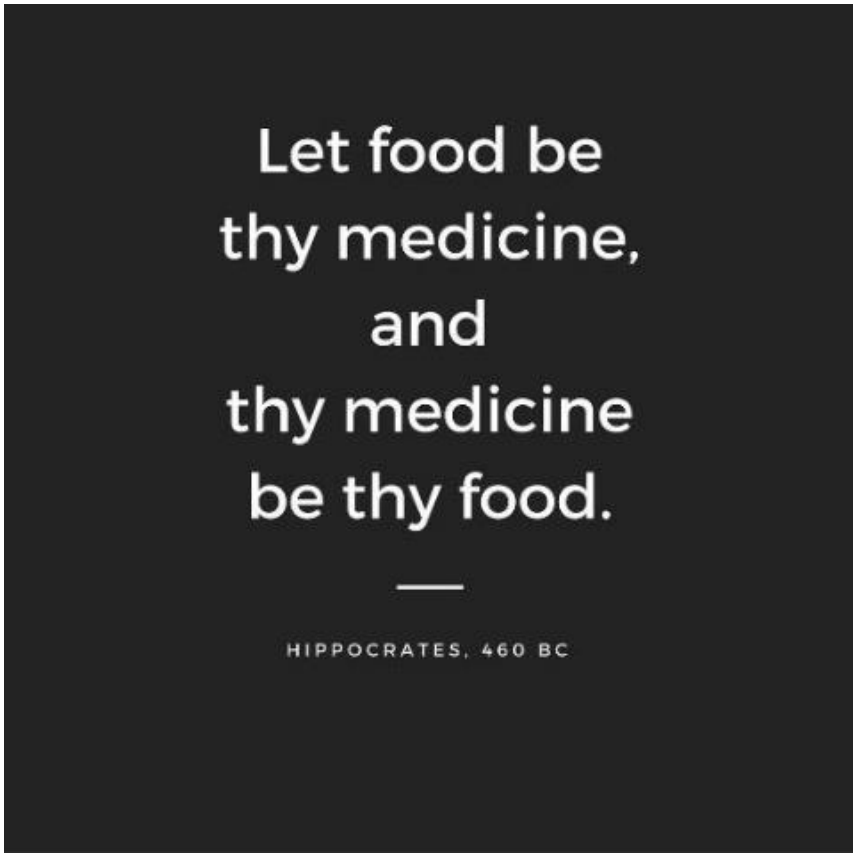
How Can We Help?

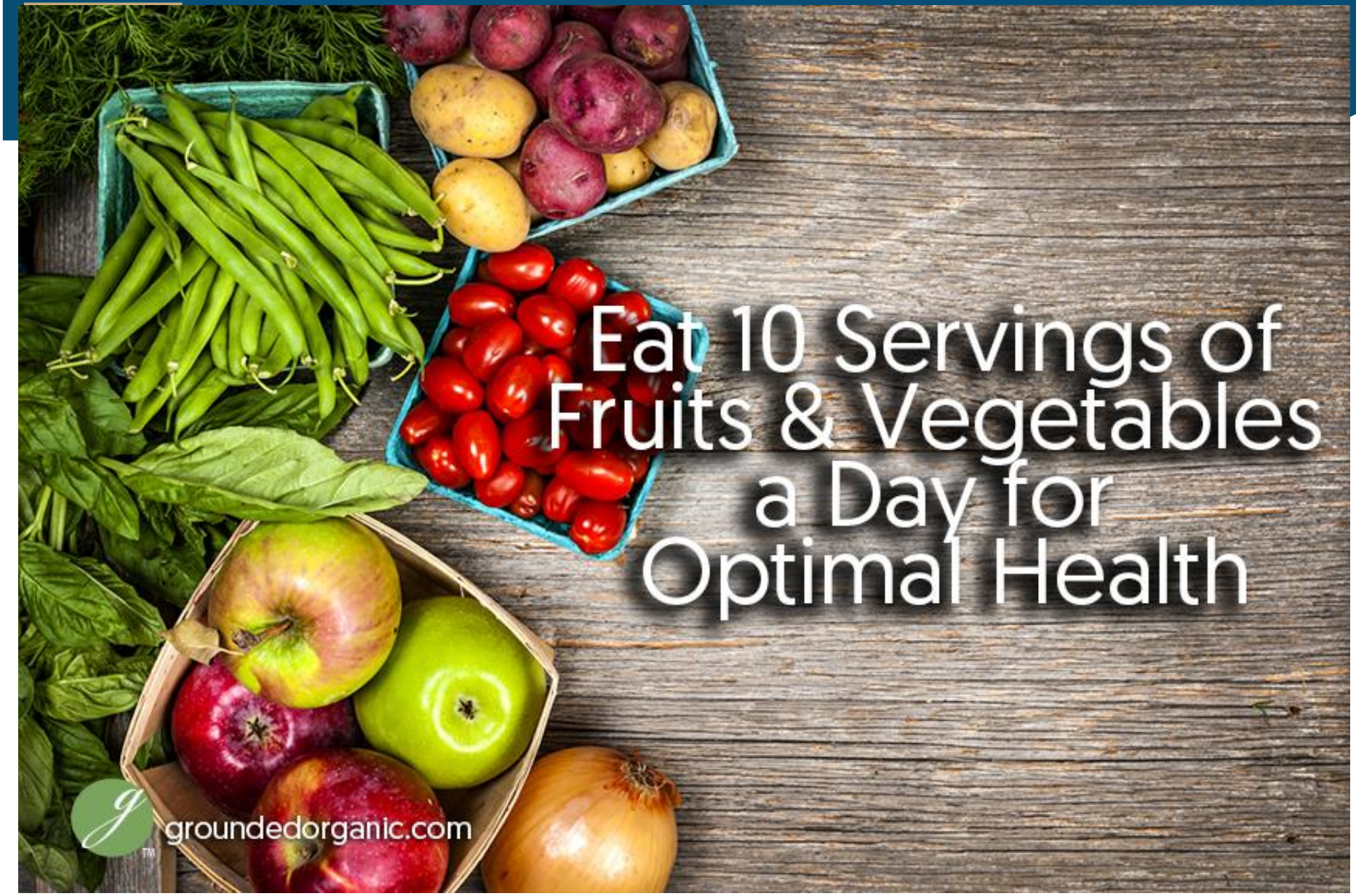
- Referral for Medical/InterProfessional Management
  - Insomnia
  - Sleep Apnea
  - Restless Leg Syndrome
- Change negative thoughts about sleep
  - Cognitive Behavioral Therapy
- Education
  - Sleep Hygiene
  - Relaxation Techniques
- Sleep Restriction Therapy
- Supplements
  - Melatonin, 5-HTP, GABA, L-Tryptophan, Valerian
- Exercise
- Greenspace Exposure
- Meditation
- Conscious Breath Practice

http://i.huffpost.com/gen/854861/images/o-HOW-MUCH-SLEEP-facebook.jpg

You Are What You Eat

- **Metaflammation**:
  - Excessive sugar, salt, alcohol, saturated and trans fats
  - inadequate fiber, fruit, vegetables, grains and certain nutrients
  - processed food versus whole foods





http://www.groundedorganic.com/wp-content/uploads/2017/02/10-servings-of-fruits-and-vegetables.jpg

How Much Do They Need?

- 5-7 servings/day
- 10 servings to reverse chronic disease
  - Prevents:
    - Cancer
      - Lowest risk observed at 10 servings per day
    - CVD
    - Premature mortality

Aune et al 2017, Meleger et al 2014

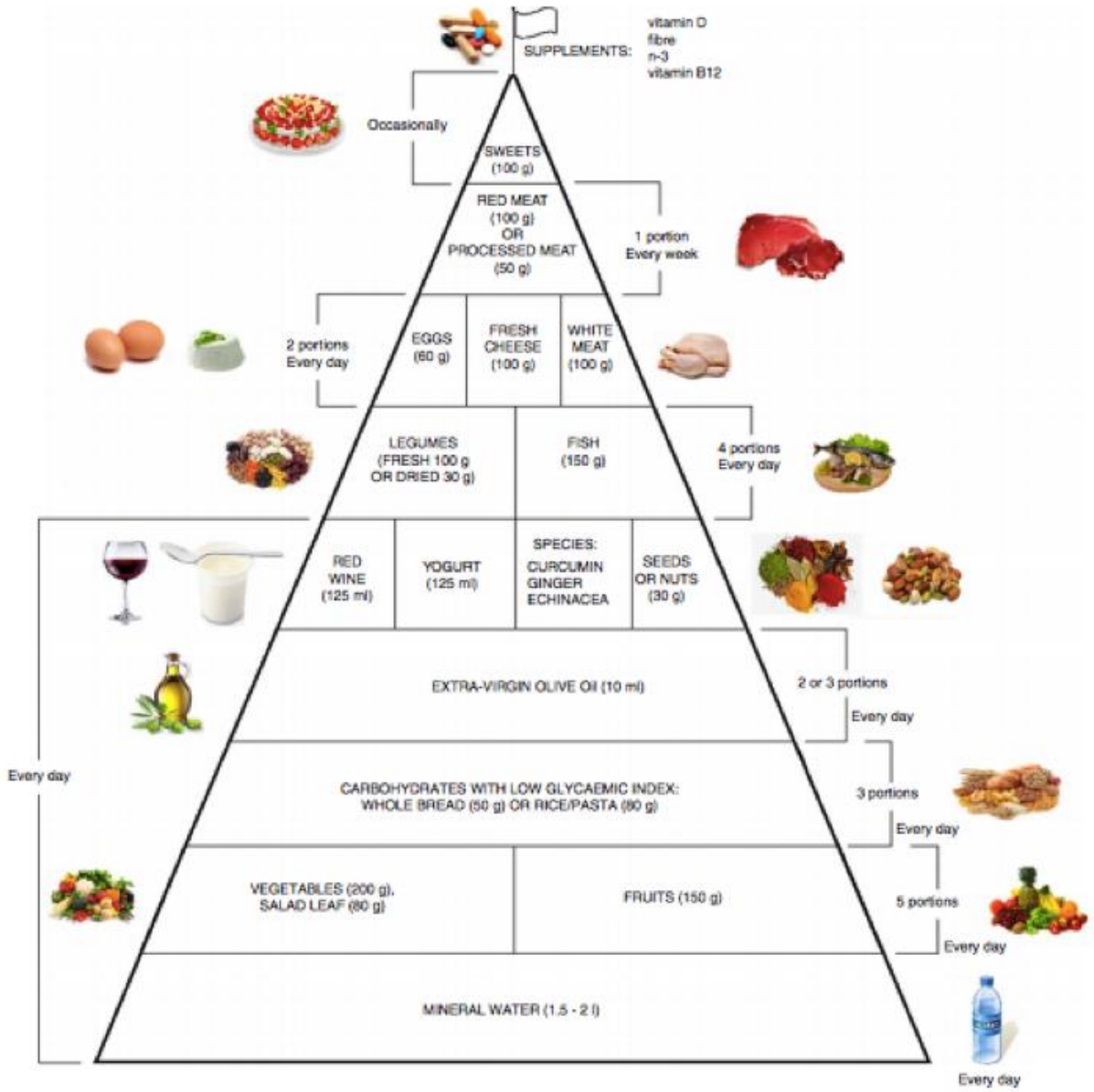
The Power of Food For Persons With Persistent Pain

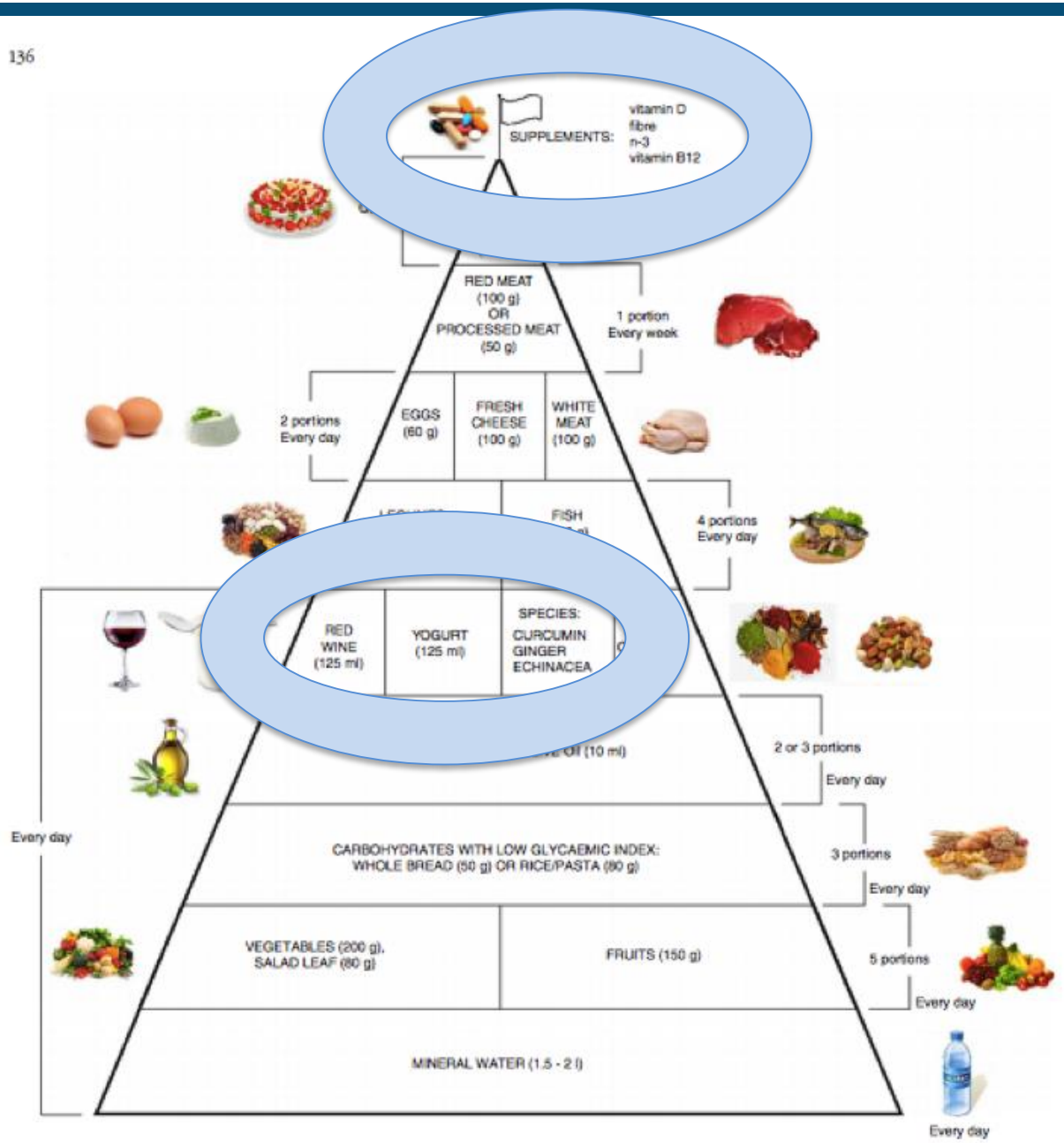
Nutrition Research Reviews (2018), **31**, 131–151

doi:10.1017/S0954422417000270

Food pyramid for subjects with chronic pain: foods and dietary constituents as anti-inflammatory and antioxidant agents

Mariangela Rondanelli[1], Milena Anna Faliva[1], Alessandra Miccono[2], Maurizio Naso[1], Mara Nichetti[1], Antonella Riva[3], Fabio Guerriero[4], Manuela De Gregori[5,6], Gabriella Peroni[1] and Simone Perna[1*]


SUPPLEMENTS:
vitamin D
fibre
n-3
vitamin B12
Occasionally
SWEETS (100 g)
RED MEAT (100 g) OR PROCESSED MEAT (50 g)
1 portion Every week
2 portions Every day
EGGS (60 g)
FRESH CHEESE (100 g)
WHITE MEAT (100 g)
LEGUMES (FRESH 100 g OR DRIED 30 g)
FISH (150 g)
4 portions Every day
RED WINE (125 ml)
YOGURT (125 ml)
SPECIES: CURCUMIN GINGER ECHINACEA
SEEDS OR NUTS (30 g)
EXTRA-VIRGIN OLIVE OIL (10 ml)
2 or 3 portions Every day
Every day
CARBOHYDRATES WITH LOW GLYCAEMIC INDEX: WHOLE BREAD (50 g) OR RICE/PASTA (80 g)
3 portions Every day
VEGETABLES (200 g), SALAD LEAF (80 g)
FRUITS (150 g)
5 portions Every day
MINERAL WATER (1.5 - 2 l)
Every day


SUPPLEMENTS:
vitamin D
fibre
n-3
vitamin B12
RED MEAT
(100 g)
OR
PROCESSED MEAT
(50 g)
1 portion
Every week
2 portions
Every day
EGGS
(60 g)
FRESH
CHEESE
(100 g)
WHITE
MEAT
(100 g)
FISH
4 portions
Every day
RED
WINE
(125 ml)
YOGURT
(125 ml)
SPECIES:
CURCUMIN
GINGER
ECHINACEA
(10 ml)
2 or 3 portions
Every day
Every day
CARBOHYDRATES WITH LOW GLYCAEMIC INDEX:
WHOLE BREAD (50 g) OR RICE/PASTA (80 g)
3 portions
Every day
VEGETABLES (200 g),
SALAD LEAF (80 g)
FRUITS (150 g)
5 portions
Every day
MINERAL WATER (1.5 - 2 l)
Every day

What about Hydration?

- Dehydration
  - Impairs Cognitive Performance
  - Impairs Physical Coordination
  - **Correlated with Pain Sensitivity**

Wittbrodt, T. & et al (2018)

Social Support

- People who have **supportive close relationships** have **lower levels of systemic inflammation** compared to people who have unsatisfactory relationships.
- Negative and competitive social interactions can increase proinflammatory cytokine activity on a daily level

Are They Ready for Change?

How important is this change to you right now?

0	1	2	3	4	5	6	7	8	9	10

not at all — unsure — extremely important

How confident are you making this change right now?

0	1	2	3	4	5	6	7	8	9	10

not at all — unsure — extremely confident

https://cdn-images-1.medium.com/max/1600/1*fi7MwXktxyd-vOhDtO6CHA.png

If less < 7, **"what might be preventing you from achieving a higher score?"**

Let's Give it a Try. . .

- Armed with this knowledge, how do you approach patients?
- Mark's case

What Did you Learn Today?

- Pain is…
- Pain is a **"Decision"** of the brain
  - based on information from the tissues,
    - regulated by the spinal cord and brain
    - involves multiple systems and experiences
- What are some ways you can evaluate the different contributions of a person's pain experience?

Will You Be Able to Recognize the Primary Pain Mechanism of Your Next Patient?

https://gardenofeaden.blogspot.com/2011/07/what-is-difference-between-zebra-and.html

Questions?

What Changes Will you make?

Key Takeaways

- Persistent pain is **common**, **complex** and **challenging**
- An understanding of **biological**, **social**, **physical** and **psychological** contexts are vital to successful outcomes
- Management should be holistic and evidence-based
  - **Pharmacological** and **non-pharmaocological**

References

Alvarez, G.G. & Ayas, N.T. (2004). The Impact of Daily Sleep Duration on Health: A Review of the Literature. *Progress in Cardiovascular Nursing*. 19(2), 56–59.

Blandpie, P.R., Gross, A.R., Elliott, J.M., Devaney, L.L., Clewley, D., Walton, D.M., Sparks, C., & Robertson, E.K. (2017). Neck Pain Revision 2017: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy*, 47(7), A1-A83. http://doi.org/10.2519/jospt.2017.0302

Breivik, H. (2011). A major challenge for a generous welfare system: A heavy socio-economic burden of chronic pain conditions in Sweden - and how to meet this challenge. European Journal of Pain, 16(2), 167–169. http://doi.org/10.1002/j.1532-2149.2011.00025.x

Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. European Journal of Pain, 10(4), 287–333. http://doi.org/10.1016/j.ejpain.2005.06.009

Brinjikji, W., Luetmer, P., Comstock, B., Bresnahan, B., Chen, L., Deyo, R., & Jarvik, J. (2014). Systematic Literature Review of Imaging Features of Spinal Degeneration in Asymptomatic Populations. American Journal of Neuroradiology, 36(4), 811–816. http://doi.org/10.3174/ajnr.a4173

References

Butler, D.S. & Mosely, G.L. (2003). *Explain Pain*. Noigroup Publications.

Buysse, D., Reynolds, C., Monk, T., Berman, S., & Kupfer, D. (1989). The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research. Psychiatry Research [serial online]. 28(2), 193-213. http://doi.org/10.1016/0165-1781(89)90047-4

Calder, P.C., Ahluwalia, N., Brouns, F., & et al. (2011). Dietary Factors and Low-Grade Inflammation in Relation to Overweight and Obesity. *British Journal of Nutrition*, 106(supplement 3), S75–S78.

Casey, Y., Greenberg, A., Nicassio, M., Harpin, R., & Hubbard, R. (2008). Transition from acute to chronic pain and disability: A model including cognitive, affective, and trauma factors. *Pain*, 134(12), 69-79. http://doi.org/10.1016/j.pain.2007.03.032

Chiang, J.J., Eisenberger, N.I., Seeman, T.E., & Taylor, S.E. (2012). Negative and Competitive Social Interactions are Related to Heightened Proinflammatory Cytokine Activity. *Proceedings of the National Academy of Sciences of the United States of America*, 109(6), 1878–1882.

Chimenti, R.L., Frey-Law, L.A., & Sluke, K.A. (2018). A Mechanism-Based Approach to Physical Therapist Management of Pain. *Physical Therapy*, 98(5), 302-314. http://doi.org/10.1093/ptj/pzy030

Courtney, C.A., Fernández-de-Las-Peñas, C., & Bond, S. (2017). Mechanisms of chronic pain - key considerations for appropriate physical therapy management. *Journal of Manual & Manipulative Therapy: Enhancing Chronic Pain Man/agement for the Manual Therapist*, 25(3), 118-127. http://doi.org/10.1179/2042618613Y.0000000050

References

Delitto, A., George, S.Z., Van Dillen, L, Whitman, J.M., Sowa, Gwendolyn, Shekelle, P., Denninger, T.R. & Godges, J.J. (2012). Low Back Pain: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy*, 42(4), A1-A57. https://www.jospt.org/doi/10.2519/jospt.2012.42.4.A1

DeSantana, J.M., Walsh, D.M., Vance, C, Rakel, B.A. & Sluka, K.A. (2009). Effectiveness of Transcutaneous Electrical Nerve Stimulation for Treatment of Hyperalgesia and Pain. *Current Rheumatology Reports*, 10(6), 492-499. http://doi.org/10.1007/s11926-008-0080-z

Egger, G., & Dixon, J. (2010). Inflammatory Effects of Nutritional Stimuli: Further Support for the Need for a Big Picture Approach to Tackling Obesity and Chronic Disease. *Obesity Reviews*, 11(2), 137–149.

Egger, G., & Dixon, J. (2011). Non-Nutrient Causes of Low-Grade, Systemic Inflammation: Support for a "Canary in the Mineshaft" View of Obesity in Chronic Disease. *Obesity Reviews*, 12(5), 339–345.

Elo, A.L., Leppänen, A., & Jahkola, A. (2003). Validity of a Single-Item Measure of Stress Symptoms. *Scandinavian journal of work, environment & health*, 29(6), 444-451. http://doi.org/10.5271/sjweh.752

Fagundes, C.P., Bennett, J.M., Derry, H.M., & Kiecolt-Glaser, J.K. (2011). Relationships and Inflammation Across the Lifespan: Social Developmental Pathways to Disease. *Social and Personality Psychology Compass*. 5(11), 891–903. http://www.doi.org/10.1111/j.1751-9004.2011.00392.x

Ferrie, J.E., Kivimäki, M., Akbaraly, T.N., & et. al. (2013). Associations Between Change in Sleep Duration and Inflammation: Findings on C-Reactive Protein and Interleukin 6 in the Whitehall II Study. *The American Journal of Epidemiology*, 178(6), 956–961.

References

Flor, H. (2000). The Functional Organization of the Brain in Chronic Pain. *Progress in Brain Research*, 129 (313-322). https://doi.org/10.1016/S0079-6123(00)29023-7.

Gaskin, D. J., & Richard, P. (2012). The Economic Costs of Pain in the United States. The Journal of Pain, 13(8), 715–724. http://doi.org.10.1016/j.jpain.2012.03.009

Goldberg, D.S. & McGee, S.J. (2011). Pain as a Global Public Health Priority. *BMC Public Health*, 11 (770). https://doi.org/10.1186/1471-2458-11-770

Grandner, M.A. (2017). Sleep, Health, and Society. *Sleep Med Clin*, 12(1),1-22.

Haack, M., Sanchez, E. & Mullington, J.M. (2007). Elevated inflammatory markers in response to prolonged sleep restriction are associated with increased pain experience in healthy volunteers. *Sleep*, 30(9), 1145-52. http://doi.org/10.1093/sleep/30.9.1145

Hooten, W.M. (2016). Chronic Pain and Mental Health Disorders: Shared Neural Mechanisms, Epidemiology, and Treatment.(SYMPOSUM ON PAIN MEDICINE). *Mayo Clinic Proceedings*, 91(7), 955-970. http://doi.org/10.1016/j.mayocp.2016.04.029

Hughes, L.S., Clark, J., Colclough, J.A., Dale, E., & McMillan, D. (2017). Acceptance and Commitment Therapy (ACT) for Chronic Pain: A Systematic Review and Meta-Analyses. *Clinical Journal of Pain*, 33(6), 552-568. http://doi.org/10.1097/AJP.0000000000000425

International Association for the Study of Pain. (2018). http://www.iasp-pain.org.

Irwin, M.R., Olmstead, R. & Carroll, J.E. (2015). Sleep Disturbance, Sleep Duration, and Inflammation: A Systematic Review and Meta-Analysis of Cohort Studies and Experimental Sleep Deprivation. *Biol Psychiatry*, 80(1), 40-52. http://doi.org/10.1016/j.biopsych.2015.05.014

Keele University & Arthritis Research UK (2007). The Keele STarT Back Screening Tool.

Khoury, B., Sharma, M., Rush, S.E., & Fournier, C. (2015). Mindfulness-Based Stress Reduction for Healthy Individuals: A Meta-Analysis. *Journal of Psychosomatic Research*. 78(6), 519-528. http://doi.org/10.1016/j.jpsychores.2015.03.009

References

Löwe, B., Wahl, I., Rose, M., et al. (2010). A 4-Item Measure of Depression and Anxiety: Validation and Standardization of the Patient Health Questionnaire-4 (PHQ-4) in the General Population. Journal of Affective Disorders, 122(1-2), 86-95. http://doi.org/10.1016/j.jad.2009.06.019

Maihofner, C., Handwerker, H., Neundorfer, B., & Birklein, F. (2003, December 23). Patterns of Cortical Reorganization in Complex Regional Pain Syndrome. Neurology, 61(12), 1707-1715. http://doi.org/10.1212/01.WNL.0000098939.02752.8E

Mäntyselkä, P., Kumpusalo, E., Ahonen, R., Kumpusalo, A., Kauhanen, J., Viinamäki, H., Halonen, P., & Takala, J. (2001). Pain as a Reason to Visit the Doctor: A Study in Finnish Primary Health Care. Pain, 89(2), 175-180. https://doi.org/10.1016/s0304-3959(00)00361-4

McConville, J., McAleer, R., & Hahne, A. (2017). Mindfulness Training for Health Profession Students—The Effect of Mindfulness Training on Psychological Well-Being, Learning and Clinical Performance of Health Professional Students: A Systematic Review of Randomized and Non-randomized Controlled Trials. Explore: The Journal of Science and Healing, 13(1), 26-45. http://doi.org/10.1016/j.explore.2016.10.002

McQuay, H.J., Kalso, E., & Moore, R.A. (2008). Systematic Reviews in Pain Research: Methodology Refined. Seattle, WA: IASP Press.

Mollayeva, T., Thurairajah, P., Burton, K., Mollayeva, S., Shapiro, C., & Colantonio, A. (2016, February). The Pittsburgh sleep Quality Index as a Screening Tool for Sleep Dysfunction in Clinical and Non-Clinical Samples: A Systematic Review and Meta-Analysis. Sleep Medicine Reviews, 25(52-73). http://doi.org/10.1016/j.smrv.2015.01.009

References

Monteiro C.A. (2009). Nutrition and Health. The Issue is Not Food, Nor Nutrients, So Much As Processing. Public Health Nutrition, 12(5):729–731.

Motivala, S.J. (2011). Sleep and Inflammation: Psychoneuroimmunology in the Context of Cardiovascular Disease. Annals of Behavioral Medicine. 42(2), 141–152.

Nahin, R. L. (2015). Estimates of Pain Prevalence and Severity in Adults: United States, 2012. *The Journal of Pain*, 16(8), 769–780. http://doi.org/10.1016/j.jpain.2015.05.002

Neblett, R., Cohen, H., Choi, Y., Hartzell, M.M., Williams, M., Mayer, T.G., & Gatchel, R.J. (2013). The Central Sensitization Inventory (CSI): Establishing Clinically Significant Values for Identifying Central Sensitivity Syndromes in an Outpatient Chronic Pain Sample. *Journal of Pain*, 14(5), 438-445. http://doi.org/10.1016/j.jpain.2012.11.012

Nijs, J., Loggia, M.L., Polli, A., Moens, M., Huysmans, E., Goudman, L., Meeus, M., Vanderweeen, L., Ickmans, K., & Claw, D. (2017). Sleep Disturbances and Severe Stress as Glial Activators: Key Targets for Treating Central Sensitization in Chronic Pain Patients? *Expert Opin Ther Targets*, 21(8), 817-826. http://www.doi.org/10.1080/14728222.2017.1353603

Pain Principles (Section 2, Chapter 6) Neuroscience Online: An Electronic Textbook for the Neurosciences: Department of Neurobiology and Anatomy - The University of Texas Medical School at Houston. (n.d.). Retrieved from https://nba.uth.tmc.edu/neuroscience/m/s2/chapter06.html

Pain Tracts and Sources (Section 2, Chapter 7) Neuroscience Online: An Electronic Textbook for the Neurosciences: Department of Neurobiology and Anatomy - The University of Texas Medical School at Houston. (n.d.). Retrieved from https://nba.uth.tmc.edu/neuroscience/m/s2/chapter07.html

References

Pelogenix, Inc. (2018). https://www.pelogenix.com

Phillips, M.D., Patrizi, R.M., Cheek, D.J., Wooten, J.S., Barbee, J.J., & Mitchell, J.B. (2012). Resistance Training Reduces Subclinical Inflammation in Obese, Postmenopausal Women. *Medicine and Science in Sports and Exercise*, 44(11), 2099–2110. http://doi.org/10.1249/MSS.0b013e3182644984

Powell, K.E., King, A.C, Buchner, D.M., & et. al. (2018). The Scientific Foundation for the Physical Activity Guidelines for Americans, 2nd Edition. *Journal of Physical Activity and Health* 16(1) 1-11. http://doi.org/10.1123/jpah.2018-0618

Ramond-Roquin, A., Bouton, C., Begue, C., Petit, A., Rouquelaure, Y., & Huez, J.R. (2015). Psychosocial Risk Factors, Interventions, and Comorbidity in Patients with Non-Specific Low Back Pain in Primary Care: Need for Comprehensive and Patient=Centered Care. *Frontiers in Medicine*, 2(73). http://doi.org/10.3389/fmed.2015.00073

Richard, C., Couture, P., Desroches, S., Charest, A., & Lamarche, B. (2011). Effect of the Mediterranean diet with and without weight loss on cardiovascular risk factors in men with the metabolic syndrome. *Nutrition, Metabolism and Cardiovascular Diseases*, 21(9), 628–635. http://doi.org/10.1016/j.numecd.2010.01.012

Salomons, T.V., Iannetti, G.D., Liang, M. & Wood, J.N. (2016). The “Pain Matrix” in Pain-Free Individuals. *JAMA Neurology*, 73(6), 755-756. http://doi.org/10.1001/jamaneurol.2016.0653

Snyder, E., Cai, B., DeMuro, C., Morrison, M.F., & Ball, W. (2018). A New Single-Item Sleep Quality Scale: Results of Psychometric Evaluation in Patients with Chronic Primary Insomnia and Depression. *Journal of Clinical Sleep Medicine*, 14(11), 1849–1857. http://doi.org/10.5664/jcsm.7478

Schuh-Hofer, S., Wodarski, R., Pfau, D.B., Caspani, O., Magerl, W., Kennedy, J.D., & Treede, R.D. (2013). One Night of Total Sleep Deprivation Promotes a State of Generalized Hyperalgesia: A Surrogate Pain Model to Study the Relationship of Insomnia and Pain. Pain, 154(9), 1613-1621. http://doi.org/10.1016/j.pain.2013.04.046

References

Staffe, A.T. Bech, M.W., Clemmensen, S.L., Nielsen, H.T., Larsen, D.B., Peterson, K.K. (2019). Total Sleep Deprivation Increases Pain Sensitivity, Impairs Conditioned Pain Modulation and Facilitates Temporal Summation of Pain in Healthy Participants. PLoS One, 14(12). https://doi.org/10.1371/journal.pone.0225849

Torrance, N., Elliott, A. M., Lee, A. J., & Smith, B. H. (2010). Severe chronic pain is associated with increased 10 year mortality. A cohort record linkage study. European Journal of Pain, 14(4), 380–386. http://doi.org/10.1016/j.ejpain.2009.07.006

Turk, D. C., Fillingim, R. B., Ohrbach, R., & Patel, K. V. (2016). Assessment of Psychosocial and Functional Impact of Chronic Pain. The Journal of Pain, 17(9). http://doi.org/10.1016/j.jpain.2016.02.006

Wager, T.D., Atlas, L.T., Lindquist, M.A., Roy, M., Woo, C., & Kross, E. (2013). An f-MRI-Based Neurologic Signature of Physical Pain. New England Journal of Medicine, 368:1388-1397. http://doi.org/10.1056/NEJMoa1204471

Wand, B.M., Parkitny, L., O'Connell, N.E., Luomajoki, H., McAuley, J.H., Thacker, M. & Mosely, G.L. (2011). Cortical Changes in Chronic Low Back Pain: Current State of the Art and Implications for Clinical Practice. Manual Therapy, 16(1), 15-20. http://doi.org/10.1016/j.math.2010.06.008

Wells, M.E., Vaughn, B.V. (2012). Poor sleep challenging the health of a Nation. The Neurodiagnostic Journal. 52(3), 233–249.

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1. Go to URL: https://www.dhaj7-cepo.com/content/clinical-communities-speaker-series-review-current-trends-and-best-practices-primary-care-28
2. Click on the REGISTER/TAKE COURSE tab.
   a. If you have previously used the CEPO CMS, click login.
   b. If you have not previously used the CEPO CMS click register to create a new account.
3. Follow the onscreen prompts to complete the post-activity assessments:
   a. Read the Accreditation Statement
   b. Complete the Evaluation
   c. Take the Posttest
4. After completing the posttest at 80% or above, your certificate will be available for print or download.
5. You can return to the site at any time in the future to print your certificate and transcripts at https://www.dhaj7-cepo.com/
6. If you require further support, please contact us at dha.ncr.j7.mbx.cepo-lms-support@mail.mil