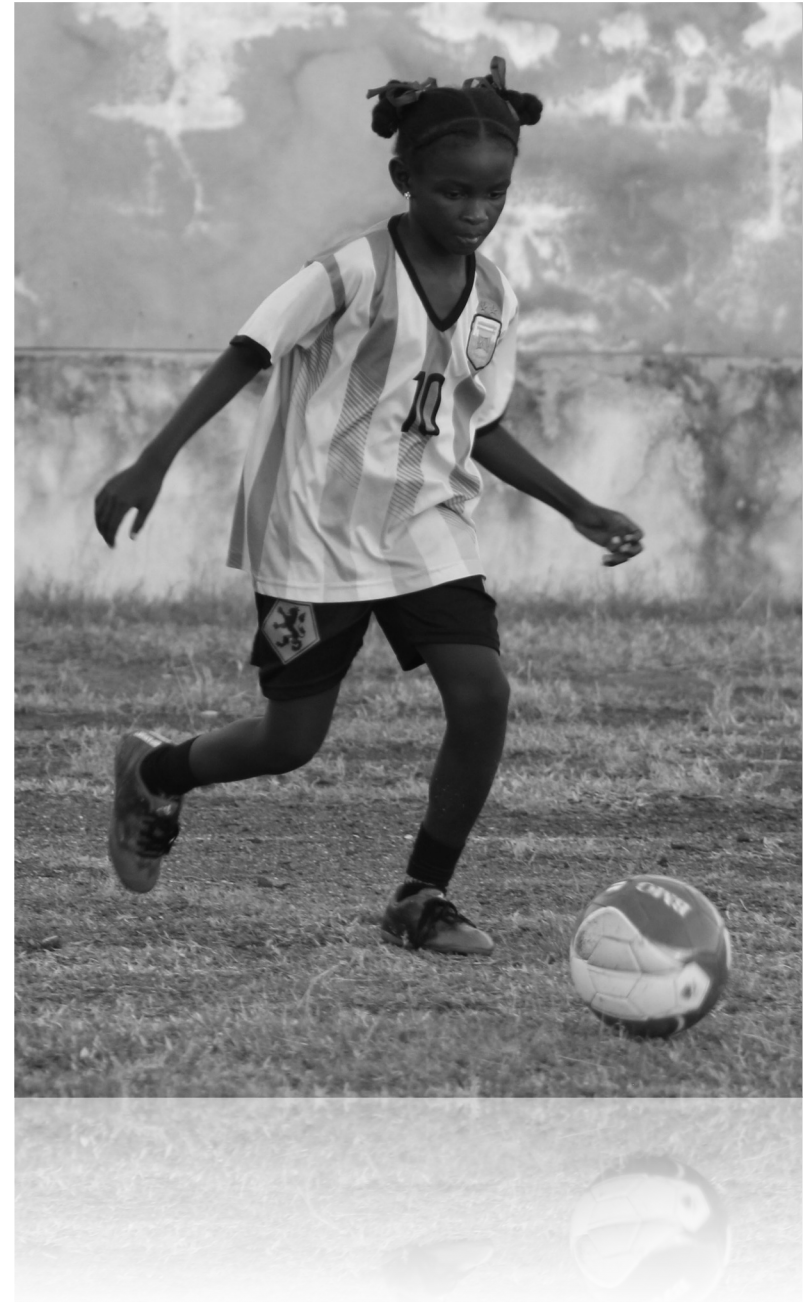


# Pain Science and How to Explain it to Patients

**Michael Sangster, PT, DPT**  
**Clinical Specialist (Pain Science)**  
**[michael.sangster@iwk.nshealth.ca](mailto:michael.sangster@iwk.nshealth.ca)**



DALHOUSIE  
UNIVERSITY



# Disclosure

No conflicts of interest to declare.

# Objectives

- Upon completion of this presentation the audience will be able to:
  - Understand the importance of a pain neuroscience education approach to the treatment of children and adolescents with pain;
  - initiate the application and implementation of the age appropriate therapeutic pain neuroscience education to children and adolescents with pain, using best evidence principles;
  - understand the role of clinician language in creating positive patient expectancy to foster improved outcome;
  - and, understand the key curricular elements of a pain neurophysiology education intervention.

**What do we actually know?**

A lot less than we think we know...

# Reconceptualizing pain

- Pain seems relatively straightforward – hitting one's thumb with a hammer hurts one's thumb...
- structural-pathology model
- supposes pain provides an accurate indication of the state of the tissues

# Traditional beliefs about pain

- Pain is an indication of
  - tissue damage
  - biomechanical dysfunction
  - irritated tissue
  - imminent damage
  - unhealed or poorly healed tissue

# Traditional beliefs about pain

- Time (acute or chronic)
- Causative factors (i.e. whiplash, RSI, etc.)
- Body part (i.e. lateral elbow pain)

# Reconceptualizing pain

- Pain does not provide a measure of the state of the tissues
- Pain is modulated by many factors from across somatic, psychological, and social domains
- The relationship between pain and the state of the tissues becomes less predictable as pain persists
- Pain is the most salient part of an activated body protection system

(Moseley, 2007)



## Professionals underestimate patients' pain: a comprehensive review

Tim Seers<sup>a,b</sup>, Sheena Derry<sup>b</sup>, Kate Seers<sup>c</sup>, R. Andrew Moore<sup>b,\*</sup>

### Abstract

Pain assessment by patients is the rule in clinical trials but may not be in clinical practice. We examined studies comparing assessment of pain by patients and professionals in clinical practice using published studies (1990-2016;  $\geq 20$  patients), in English, in an institutional setting, comparing pain assessment within 24 hours by patients and health care professionals. A difference of at least 10% of the maximum score was considered significant. We judged quality on sampling method, blinding, and study size. Eighty studies (20,496 patients) provided data from a range of settings and locations; most (51%) used unbiased sampling, and most (68%) were blind or probably blind. Nine studies with  $\geq 500$  patients involved 58% of patients; 60 with  $< 200$  patients involved 25%. Large studies were more likely to use comprehensive or random sampling and blinding of patients and professionals. Underestimation of pain by professionals compared with patients was reported by 62/80 studies (78%); there was no difference in 17 (21%) and overestimation in 1 (1%). Underestimation was reported in 75% of large studies ( $> 500$  patients), 91% of mid-sized studies (200-400), and 78% of small studies ( $< 200$ ). High-quality studies (blind, comprehensive, or random sampling,  $> 200$  patients) consistently reported underestimation (10/11; 91%). The extent of underestimation tended to increase with pain severity. Professionals consistently tend to underestimate pain compared with assessment by patients. This tendency is more pronounced with more severe pain, and the extent of underestimation can be large. It is likely that this contributes to undertreatment of pain.

**Keywords:** Pain, Measurement, Professional, Patient, Concordance

# Pain and neuroplastic change

- Conventional therapeutic models are rooted in a structural pathology paradigm (Pelletier, Higgins, & Bourbonnais, 2015, p. 1583).
- Neurophysiological change is observed in the development of persistent pain including:
  - peripheral sensitization resulting in increased nociceptive responsiveness;
  - and, central sensitization resulting spinal cord signal amplification.

(Pelletier et al., 2015, p. 1583)

# The brain and pain

- Neuroplastic changes in cortical regions related to descending inhibition, sensory discrimination, and sensori-motor function (Pelletier et al., 2015, p. 1583).
- Reduced grey matter volume in cognitive-emotional, sensori-motor, and pain modulatory brain regions in patients with pain (Erpelding et al., 2016, p. 1102).
- Evidence for a causal relationship between neuroplastic change and pain (Pelletier et al., 2015, p. 1583).

# Moving with pain

- Alterations in brain and nervous system circuitry have profound impacts on pain processing, body perception, motor control, immobility, and kinesiophobia (Tajerian & Clark, 2017, p. 3).
- Neuroplastic changes are distributed across the cortical contributors to movement resulting in abnormal movement patterns (Silfies, Vendemia, Beattie, Stewart, & Jordon, 2017, p. 2051).
- Pain might be considered a perceptual inference - a “best guess” that protective action is required (Lotze & Moseley, 2015).

# Seeking certainty

- Patients reported being very uncertain

“I had just no frame of reference to figure out like what it was...with my back. I don't know, and I don't know what I need to do to heal it, so I'm just completely in the dark”

- Clinicians were seen as providing the most certainty
- High levels of trust and therefore in a position to be very influential on participants' beliefs.

(Darlow et. al., 2013)

# Diagnostic uncertainty

- Clinicians' inability to provide a clear pathological cause and label that explains symptoms and leads to a selection of an intervention to cure a problem.
- Subjective perception of an inability to provide an accurate or correct explanation of the patient's health problem.

(Pincus et. al., 2018)

# Expectations

- Recovery expectations can be heavily influenced by single, at times off-hand, statements
- Clinicians can contribute to avoidance beliefs directly by focusing upon pathoanatomic explanations which are interpreted as meaning the spine is vulnerable and requires protection.
- Reassurance and positive prognostic expectations can have a very beneficial effect

(Darlow et. al., 2013)

# Cognitive emotional social

- Catastrophic interpretations of pain and believing pain to be an accurate indicator of the state of the tissues are associated with higher pain ratings
- Believing that the nervous system amplifies noxious input in chronic pain states increases pain threshold

(Moseley, 2004)

# The power of fear in recovery

- Patients with greater fear on the TSK-II at RTS were:
  - 4 times more likely to report lower levels of activity
  - 7 times more likely to have a hop limb symmetry lower than 95%
  - 6 times more likely to have quadriceps strength symmetry lower than 90%
  - patients who went on to suffer an ipsilateral second ACL injury had a greater TSK-II score at the time of RTS than those who did not suffer a second ACL injury
  - patients with a TSK-II score of 19 or greater at the time of RTS were 13 times more likely to suffer second ACL tear within 24 months after RTS

(Paterno et. al. 2017)

# So what do we really know?

- Pain is about WAY more than just the issues in the tissues... but they are important...
- A bunch of stuff affects pain...
- Pain can change the brain...
- Persistent pain seems to be as a consequence of an exaggerated perception of threat...
- The more pain you expect, the stronger your brain responds to the pain... and the stronger the response, the greater the expectation.

# So what can we do?

...we probably should treat those things... and we probably should try to treat under the radar of that defensive pain response...

But how?

# The PT as 'movement specialist'

“Pain is best seen as a need state, like hunger and thirst, which are terminated by a consummatory act.”

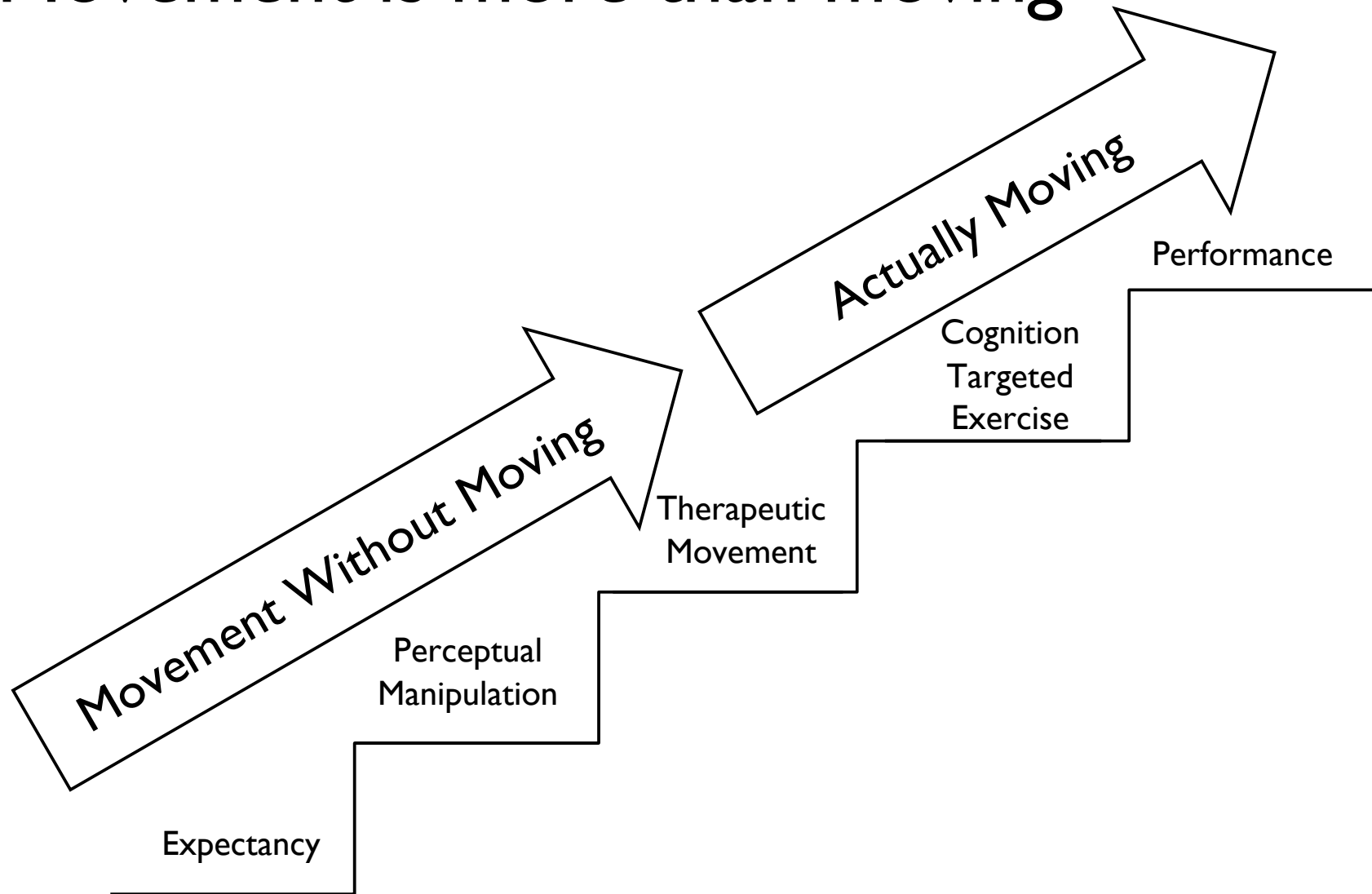
- Patrick Wall

# Moving with pain

How then can we start a movement...

...that the patient's brain does not yet have an  
opinion of?

# Movement is more than moving



# What matters most to people in musculoskeletal physiotherapy consultations? A qualitative study

## Accepted Manuscript

What matters most to people in musculoskeletal physiotherapy consultations? A qualitative study

Rob Stenner, Shea Palmer, Ralph Hammond

PII: S2468-7812(18)30069-9  
DOI: 10.1016/j.msksp.2018.03.005  
Reference: MSKSP 174

To appear in: *Musculoskeletal Science and Practice*

Received Date: 20 December 2017

Revised Date: 13 February 2018

Accepted Date: 9 March 2018

Please cite this article as: Stenner, R., Palmer, S., Hammond, R., What matters most to people in musculoskeletal physiotherapy consultations? A qualitative study, *Musculoskeletal Science and Practice* (2018), doi: 10.1016/j.msksp.2018.03.005.



## Conclusion

For this group of people an **understanding of their problem** appeared to be more valued than other matters. People need to **understand their medical conditions in order for them to take an active role in their health care**. For the clinician this means it is **imperative that they understand pathology and contemporary pain biology concepts as they relate to musculoskeletal pain so that they can engage in positive dialogue with people to address their reported need for an explanation and understanding**.

For people, systems and approaches are needed to **support them to think about 'what matters to them'**. This may help them to set their priorities for the consultation and engage in more **meaningful conversations with clinicians**. Achieving desirable health outcomes is more likely when **people actively participate in their care**. Clinicians also need to be flexible. Responding to **each patient as a person is essential as no single dimension of person-centred care exists without reliance on other dimensions**. At the centre of this process is **effective communication** (Cooper et al., 2008) to fully engage the person in the process so that the issues of importance that people bring to a consultation can be successfully identified, and addressed.

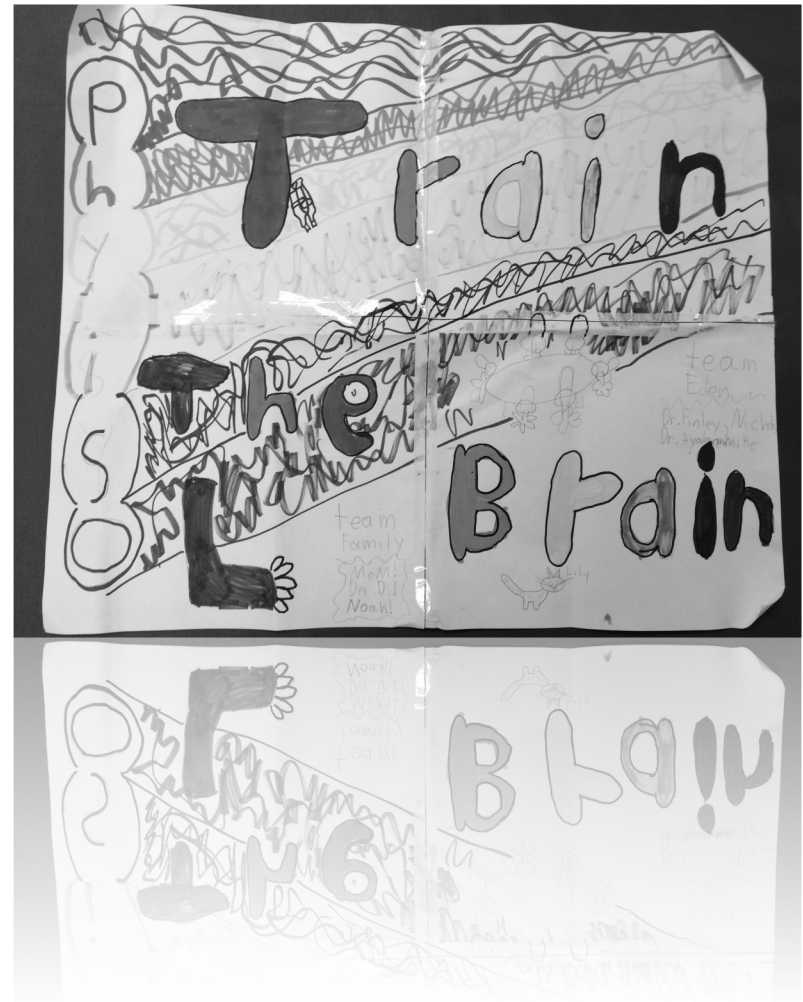
# Psychologically informed PT

- Psychologically informed physical therapy (PIPT) blends psychological strategies within a physical therapist's treatment approach for the prevention and management of chronic musculoskeletal pain.
- Treatments target maladaptive cognitions, emotions, or behavior with physical rehabilitation are more effective than physical treatment alone.

(Coronado et. al., 2020, p.2)

# Moving in on fear

- Pain neurophysiology education (PNE) is indicated to address maladaptive pain cognitions related to movement (Nijs Gírbés, Lundberg, Malfliet, & Sterling, 2015, p. 217).
- Purported to decrease amygdala, insula, and somatosensory cortex activity (Nijs et al., 2015, p. 217).



# PNE... when?

- Pain physiology education is indicated when the clinical picture is characterized and dominated by central sensitization; and maladaptive pain cognitions, illness perceptions or coping strategies are present

(Nijs et al., 2011, p. 415)

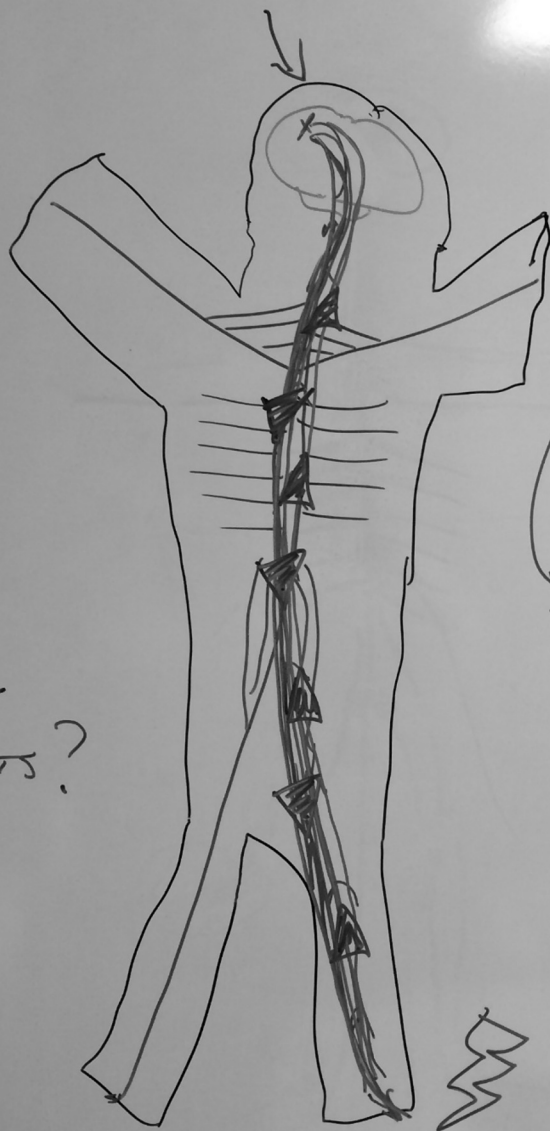


# PNE... what?

- Seven target concepts
  - There are many potential contributors to anyone's pain
  - We are all bioplastic
  - Pain is not an accurate marker of tissue state
  - Pain education is treatment
  - Pain is a brain output
  - Pain is a protector
  - Pain can become overprotective/sensitized

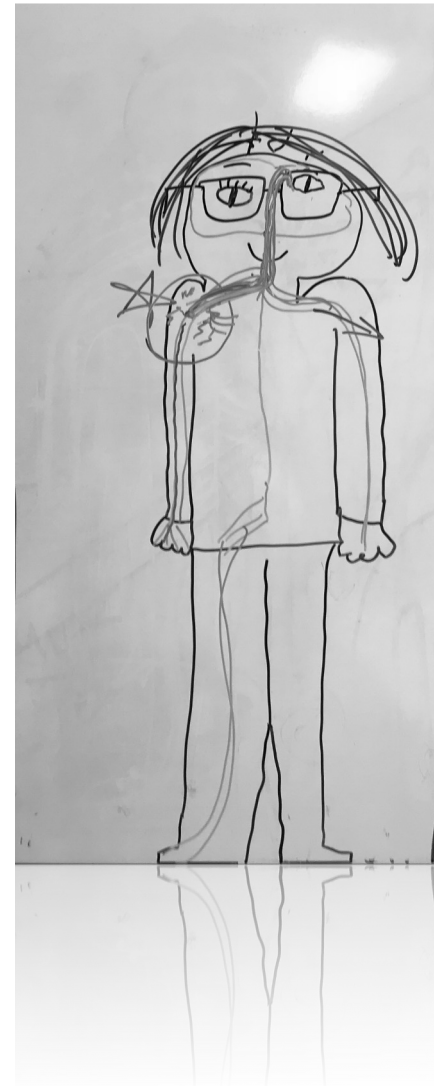
(Heathcote, 2018)

?  
IS THIS REAL?  
IS FALLING NORMAL?  
IS THIS GOING TO GET BETTER?  
MRI RESULTS?



# Moving in on fear

- PNE has demonstrated positive effects on descending noxious inhibitory control (vanOosterwijck et al., 2013, p. 887).
- Single PNE session showed marked reduction in brain activation as measured by fMRI (Moseley, 2005, p. 52).
- PNE reduces pain, improves knowledge of pain, function, perceived disability, psychosocial factors, and enhances movement, and minimizes healthcare use (Louw, Zimney, Puentedura & Diener, 2016).



# Moving in on fear

- PNE and exercise in the management of chronic musculoskeletal pain results in greater short-term improvements in pain, disability, kinesiophobia, and pain catastrophizing relative to exercise alone (Siddall et. al., 2022).
- Dose seems to matter
  - Linear relationship was observed between longer duration of PNE (total minutes) and changes of psychosocial variables
  - Dose of 100, 200 and 400 min of PNE was estimated to exceed the minimum clinically important difference for kinesiophobia, anxiety, and catastrophizing

(Salazar-Méndez et al., 2023)

# PNE... how?

- Understanding pain in 5 minutes or less

<http://www.youtube.com/watch?v=RWMKucuejls>

- Why things hurt

<http://www.youtube.com/watch?v=gwd-wLdlHjs>

- The mystery of chronic pain

<http://www.youtube.com/watch?v=J6--CMhcCfQ>

- Tame the beast

<https://www.youtube.com/watch?v=ikUzvSph7Z4>

(Heathcote, 2018)

# Moving through fear

- Exercise to alter pain memories?
  - Cognition-targeted exercise therapy is a graded approach to movement intended to facilitate systematic desensitization through creation of adaptive movement memory.
  - Purported to target the amygdala and its associated brain circuitries.
  - PNE and cognition-targeted exercise therapy act synergistically.

(Nijs et al., 2015, p. 217)

# Cognition targeted exercise therapy

- Preparing patients for cognition-targeted exercise therapy using therapeutic pain neuroscience education
- Cognition-targeted = time-contingent exercises using goal setting
- Cognition-targeted = addressing patients' perceptions about exercises
- Cognition-targeted = tackling the feared movements & activities
- Using stress for altering movement-related pain memories

(Nijs et al., 2014)

# Moving

- Pain neuroscience education combined with cognition targeted motor control training improved pressure pain sensitivity, central sensitization symptoms, mental and physical functioning, kinesiophobia, and hypervigilance and reduced disability in patients.
- 50% improvement in pain maintained at long-term follow-up.
- Emphasizes the need for a shift from a biomedical approach toward a biopsychosocial approach rather than focusing on a possible biomedical origin of pain.

(Malfliet et al., 2018)

# Conclusion

- We know less than we think we do.
- There is a lot going on north of CI.
- We might be able to offer patients certainty in the uncertainty of persistent pain.
- Movement is more than just movement.

