Teaching Patients about Pain: Pain Neuroscience Education

Stephen Schmidt, PT, MPhysio
Kaiser Foundation Rehabilitation Center - Vallejo, CA
IPNF - International PNF Instructor
ISPI & ISPI/EM TPS Senior Faculty
OCS - Orthopaedic Certified Specialist
Fellow – AAOMPT
RNG - Really Nice Guy
stephen.g.schmidt@kp.org
linkedin.com/in/stephenschmidtpt

Disclosure Statement of Financial Interest
I teach for a seminar company offering continuing education for healthcare providers.
The session is not designed to promote the attendance of the seminars or purchase of products.

got pain?
~30% of the population in the USA experience an ongoing pain state*.

Pain without apparent biological value persisting beyond expected healing time (generally >3-6 months)


...116,000,000 people!

Management cost = $600,000,000,000 per year!

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In their 2011 study, Mezei and Murinson found that a number of American medical schools did not report any teaching of pain whatsoever, with many requiring 5 or fewer hours of such education. Elective courses were available in 16% of schools; 80% of American medical schools had no formal pain education.

“The relief of suffering, it would appear, is considered one of the primary ends of medicine by patients and lay persons, but not by the medical profession.” Eric Cassell
Friday Afternoon: 5pm Eval


Only a “few” issues...

• 3 years
• Diagnosed with FM
• Numerous healthcare providers
• Good and bad days...
• Spreading pain
• Pain comes and goes; have “a mind of its own.”
• Stress increases her pain considerably.
• She does not sleep well

Only a “few” issues...

• She has had to stop cooking
• Standing < 20 min, pain lasts 1-2 days
• Sit < 60 minutes.
• ODI = 34,756,595
• General health good
• Used to work out: Pilates and Yoga
• Family history of LBP
• Unable to work (part-time office manager)
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Physical Examination

- Flexion: 10 degrees = pain
- Extension: 10 degrees = pain
- SLR = sensitive at 45 º (L = R)
- Slump = leg pain with neck flexion
- Palpation: Tender C0 – L91
- Stabilization: Unable to perform a coordinated deep stabilizing contraction

Louis Gifford

Patients want to know...
1. What is wrong with me?
2. How long will it take?
3. What can I (the patient) do for it?
4. What can you (the clinician) do for it?
5. How much will it cost (We added this one)

Let's try it with an ankle sprain...

- What is wrong with me?
- How long will it take?
- What can I (the patient) do for it?
- What can you (the clinician) do for it?
- How much will it cost?
**How about with Suzy?**

- What is wrong with me?
- How long will it take?
- What can I (the patient) do for it?
- What can you (the clinician) do for it?
- How much will it cost?


**Evidence to the rescue?**

Clinical Prediction Rules...

Pragmatic application of a clinical prediction rule in primary care to identify patients with low back pain with a good prognosis following a brief spinal manipulation intervention

A Clinical Prediction Rule for Classifying Patients with Low Back Pain Who Demonstrate Short-Term Improvement With Spinal Manipulation

Preliminary Development of a Clinical Prediction Rule for Determining Which Patients With Low Back Pain Will Respond to a Stabilization Exercise Program

Is There a Subgroup of Patients With Low Back Pain Likely to Benefit From Mechanical Traction? Results of a Randomized Clinical Trial and Subgrouping Analyses

**Will this work for Suzy?**

- Pain less than 16 days
- Pain not below the knee
- Low fear-avoidance
- Spine hypomobility
- One hip IR > 35 degrees

Will this work for Suzy?

Lumbar Traction
- Leg symptoms
- Signs of nerve root compromise
- Peripheralization with extension
- Crossed straight leg raise


Will this work for Suzy?

Spinal Stabilization
- SLR > 90 degrees
- Laxity (Beighton ligamentous laxity scale)
- Positive prone instability test
- Younger patients
- Aberrant motions
- Low fear-avoidance
- Lumbar hypermobility


Will this work for Suzy?

Directional Preference
- Extension
- Flexion

Returning to Suzy...

- Various cognitive issues...
  - short term memory, concentration
- FABQ = State Record!
- Catastrophization
  - Provocative language
- Differing Dx
- Failed treatments
- Social withdrawal

Cognitions and Pain

- It is well established that cognitions and pain are inter-related:
  - Fear
  - Catastrophization

Fear

- Definition: A distressing negative experience induced by a perceived threat
- Fear-Avoidance Beliefs Questionnaire
- Tampa Scale of Kinesiophobia
- Clinical...

References:

“Fear is the anticipatory emotional response to imminent threat, and adaptive learning takes place rapidly, either through direct experience, observation or verbal instructions.”

Conditioned Stimuli

Unconditioned Stimuli

Neutral

Fear Avoidance

Safety-seeking

Conditioned Responses

Interrupt
Selective Attention
Escape...

Unconditioned Responses

Conditioned Stimuli

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Update: Fear-Avoidance Model

Conditioned Stimuli

Unconditioned Stimuli

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Update: Fear-Avoidance Model

Catastrophization

• Inability to foresee anything other than the worst possible outcome, however unlikely, or experiencing a situation as unbearable or impossible when it is just uncomfortable
• Pain Catastrophization Scale
• Clinical...
Impaired beliefs...

- Pain is always bad
- All pain must be gone before engaging in normal activity and movement (and therapy)
- Passive treatment is the answer
- Pain will increase with any/all activity
- Work is potentially harmful


• 6% of LBP sufferers consume > 50% of the cost associated with LBP
• 10% of the claims lead to 86% of the costs


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Yellow Flags

Emotions:
- Fear of increased pain
- Depression
- Irritability
- Anxiety
- Stress

Family:
- Overprotective
- Punitive responses


Behaviors:
- Extreme pain ratings
- Extended rest
- Poor compliance
- Extreme pain ratings
- Excessive reliance on aids/devices
- Sleep disturbance
- High intake of alcohol or medication
- Smokers

Work:
- Manual work
- Work history
- Belief that work is harmful
- Unhappy at work
- Low educational background
- Working shifts
- Negative previous experiences at work with LBP

Compensation:
- Lack of financial incentive to return to work
- Extended time off work
- Number of claims
- Previous history of LBP

Yellow Flags

- Sanctioning disability
- Conflicting diagnosis
- Language
- Passive Treatments
- Number of health care providers
- "Techno-fix"
- Lack of satisfaction
- "If it hurts – don’t do it"
- Selling treatment in numbers

Suzy & pain cognitions

Afraid; poorly understood; movement = pain due to tissues being damaged

We need to dig deeper with someone like Suzy...

- What does Suzy know about her back pain?
- What does Suzy want to know about her back pain?
- What do you want Suzy to know about back pain?
To treat patients such as Suzy, we need to change:
- Cognitions
- Beliefs
- Fear

...before movement-based THERAPY can be effective...


Emerging research offers compelling evidence that explaining to patients their pain experience from a biological and physiological perspective of how the nervous system & brain processes pain allows patients to move better, exercise better, think different about pain, push further into pain, etc.


Types of Education
- Verbal 1:1
- Video/DVD
- Booklets
- Advertising
- E-mail
- Internet/Web
- Anatomy models
- Back school
- Others?
Verbal 1:1 education

Education via video...

Olivera, et al 2006; Spine: Whiplash education in the ER

Favorite video tools?

- Understanding Pain in less than five minutes: https://www.tga.gov.au/chronic-pain-management-video-resource-brainmap

- Whiteboard Health Videos: https://www.reframehealthlab.com/category/whiteboard-health-videos/
Education & booklets...

Every handed out something like this?

Education & media

- TV, media & advertising
  Mass communication

Low Back Pain is Normal

Buchbinder, Jolley 2005
Education via [secure] email

- E-mail
- Internet/Website

Louw A. Therapeutic neuroscience education via e-mail: a case report. Physiotherapy theory and practice. Apr 29 2014.

Internet education

Do any of your patient ever go to the internet for answers to their medical problems?

Education & Anatomic models: “You have a bulging disc.”
Research into anatomy, biomechanical and pathoanatomy models

Not only have these models shown limited efficacy in decreasing pain and disability, but they may increase fear in patients, which in turn, may increase their pain.

(Greene, Appel et al. 2005; Morr, Shanti et al. 2010)

Bio-medical education work?

• **Does it work?** (systematic reviews)
  • May have benefit for acute and sub-acute LBP, but not chronic (Engers, Jellema et al. 2008)
  • Helps with anxiety prior to surgery (Galaal, Deane et al. 2007)
  • No evidence for any neck pain disorders (Gross, Aker et al. 2000)
  • No evidence for neck pain ± radiculopathy (Haines, et al. 2008)
  • No evidence for preoperative education for knee or hip replacement (McDonald, Hetrick et al. 2004)
  • **Helpful in kids with asthma** (Wolf, Guevara et al. 2003)

Comprehensive Review

Back schools for the treatment of chronic low back pain: possibility of benefit but no convincing evidence after 47 years of research—systematic review and meta-analysis

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Bio-medical education

• Why not?
  • It would seem education SHOULD help?!?

• We believe the reason why education failed is due to the CONTENT of the message:
  • Biomedical does not explain pain
  • Biomedical may induce fear
  • Biomedical does not include the brain, nervous system and pain processing

Education

• Why educate patients in PAIN about anatomy and biomechanics?

• Why not just teach them more about....PAIN?!??

Practical application?

Here’s some examples:

Lorimer Moseley
• 34 year-old female
• 4.5 years of pain
• Started as LBP, then spread to her buttocks and now into both legs
• Pain would flare up with stress at work
• First child 2.5 years ago—“horrible” labor, delivery and pain
• Now constant LBP
• Not able to return to work
• Now severe spasms in both legs
• CT, MRI and X-Ray WNL
• Meds: High doses of pain killers and narcotics

**Segmental Spinal Stabilization Exercises:**
- Detailed instructions, to do training for 5 minutes each waking hour
- After 1 week practice
- 2nd scan

• After 2nd scan did 1 to 1 pain physiology education with Lorimer then immediately for scan #3
Remember Suzy?

- Doctor’s wife
- Years of “chronic LBP” now has FM too
- Numerous different treatments from different providers
  - ODI = >75%
  - “Surgeons won’t touch her”
  - MRI – severe DDD


Forward flexion...

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1st PT session

• Thorough patient interview
• Skilled, “low tech” physical examination
• Pain neuroscience education:
  • Explain why she still has pain
  • Pain drawing
  • Moseley brain scan (2005)
  • Prognostic information
  • Self-treatment ideas and plan
  • What PT can do for her
  • GOALS
  • 1st session = 75 minutes...

After the 1st session (75 minutes later)

• ODI, Zung depression scale, RMDI significantly better after

Preoperative Neuroscience Education: Single fMRI case

MRI: marked herniated L5/S1 disc; central and left towards the nerve root

Preoperative Neuroscience Education: Single fMRI case


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Preoperative Neuroscience Education for Lumbar Radiculopathy: A Multicenter RCT

64 Patients scheduled for L-Surgery

32 Surgeon Education

32 Surgeon Education + Neuroscience Ed

Low Back Pain Leg Pain Oswestry Fear Avoidance Pain Catastrophization Pain Knowledge Surgery Experiences Cost Analyses

Preoperatively 1, 3, 6 and 12 months postop

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Preoperative Neuroscience Education for Lumbar Radiculopathy: A Multicenter RCT

• One year follow-up
• Superior results (no statistical significance):
  • Back Pain
  • Leg Pain
  • Catastrophization
  • Fear Avoidance
  • Pain Knowledge

But...

Satisfaction with LS

Healthcare costs

So how do you do it?

- Teaching is not new to PT clinical practice, but... don’t assume teaching people about pain means that it is a hands off approach
- Just like many other PT skills... it takes practice
- Clinician knowledge
- Lots of methods
- Resources
- Learning styles
- Etc.


3 year follow up in Journal of Spine Surgery. 2017

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DIY: Foundations

- Listen
- Be systematic in your assessment approach to identify relevant pain mechanisms (e.g. nociceptive, peripheral neurogenic, central...)
- Ask deliberate questions to clarify “e-flags” things which need education

Foundations

- Be alert to potential harmful or incorrect pain beliefs during all patient interactions (and be prepared to address them)
- Address the list of patient questions (baby steps, one at a time)

Build a story that works

Where to start?
- Meet the patient where they are
- Ask if they want to know how their pain works
- Break down the story of how pain works into manageable units
- Big picture then the details or reverse?
Nearly nine out of ten adults may lack the skills needed to manage their health and prevent disease (health.gov)

If healthcare in general is struggling... how are therapists doing?

Stories are “sticky”
Alarm metaphors
the brain as protector

Another way to visualize your alarm

2. Nerve sensors
- When in good sensors are
  functional, just enough to give
  us the cues (touch, pressure, etc)

- With pain, leads produces more of some sensors, makes you more sensitive & activate the alarm

- Your sensors are constantly changing, based on what your
  brain thinks is needed for most survival

- As the threat ease or you understand more, fewer sensors
  operate

- E.g., when it is cold and you get a tag in your arm, your
  sensors are just telling you that it is cold, if you are not
  worried, over time your body will take away extra sensors

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5. Lions & stress

- Motor pain systems
- Sleep
- Immune
- Endocrine
- Reproduction
- Sympathetic
**What do you expect?**

- YES! That’s it, I feel better already!
- Yes, I “understand” and have intent to change
- Yes, I get it, but my situation is different (and have no intention to change)
- Whatever… just fix it!@#!
- No! I reject you and your explanation

**Main questions from patients?**

1. How do you know this?
2. Why this happen?
3. How do I get the alarm to settle down?

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**PNE power tools for improved effectiveness...**

**PNE+**

**Pain Neuroscience Education**
**Aerobic Exercise**
**Sleep Hygiene**
**Goal Setting**

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**Setting goals**

Often reported as challenging & frustrating
- Fundamental component of effective clinical practice (usually required)
- Measures rehabilitation effectiveness
- Enhances patient motivation

Schmidt (2016)
Goal suggestions

- Set some initial goals (regulatory) and frequently revisit; have patient develop goals then collaborate
- Categories: ICF?
  - Body structure/function & Activity
  - Participation
  - Environment
  - Personal factors
- Make the plan toward the goals simple, and easy to follow
- Don’t assume comprehension (test them)
- Constantly reinforce

Goal Setting/Pacing/Graded Exposure

Patient Example:
- Meals
- Laundry
- Sweeping floors
- Answering e-mails
- Weeding a garden
- Walking
- Sex
- Etc.

Putting the plan to action

- People with ongoing persistent pain have been shown to have impaired executive function, learning and working memory (Berryman et al; 2013 & 2014)

- How would you deal with someone with memory problems?
  - Log book, journal, memory book, multiple domains (written, verbal, video/audio recording, say back, teach someone, quiz)
  - Make a detailed schedule
  - Accountability
  - Planning app/planner, calendars, calendar reminders, sticky note
  - Techno reminders – secure email

Movement is the biggest pain killer on the planet

A six mile run stimulates endorphin release that is equivalent to 10mg of morphine


There are thresholds for both the intensity (>50% Vo(2)max) and duration (>10 min) of exercise required to elicit exercise analgesia


Exercise dose?

One of the main roles of the brain is PROTECTION

Protect by pain line

Safety Danger
Specificity & timing of exercise...

- Group 1: asked to exercise once for twenty minutes during the next week - 29%
- Group 2: given the same challenge + detailed information about the significant role exercise plays in reducing the risk of heart disease – 39%
- Group 3: was asked to commit to exercising at a specific time, on a specific day, at a designated location. For this group, compliance more than doubled to an extraordinary 91%


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Exercise and Pain

**PNE**

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Movement to re-code pain-related memories and aversive associations

Consider ways to “uncouple” movement or feared thoughts as threats (create safe memories)
- Aspects of graded motor imagery (laterality, motor imagery, mirror therapy, action observation, etc.)
- Movement components: move remote areas or opposite side, part of the extremity but not painful part
- Context: safer environment, distraction, favorite music, in social situation, different postures, watching in a mirror, games/play/story/dance, etc.

A little bit often (neuroplasticity principles); consistent, repetitious, progressive, salient, intense, etc.

**Movement to re-code** pain-related memories and aversive associations

Progression of physical activities and manual therapy
- Biomedical vs pain neuroscience explanations
- Using the body is a way to retrain the brain
- Exercise and manual therapy to reframe pain memories and aversive associations
- Downregulating the protect by pain system
- Needs lots of practice (therapeutic alliance, homework, patient understanding, overlap with motor imagery, behavioral change, self efficacy, etc.)


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**Update: Fear-Avoidance Model**

![Fear-Avoidance Model Diagram](image)

- Nociception → Pain → Priority to pain control → Priority to valued life goals → Recovery
- High vs low threat
- Positive affect → optimism
- Negative affect → harm representation


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**Update: Fear-Avoidance Model**

![Fear-Avoidance Model Diagram](image)

- Generalization
- Interference
- Conditioned Stimuli → Unconditioned Stimuli
- Unconditioned Responses
- Conditioned Responses
- Fear → Avoidance → Safety-seeking
- Interrupt → Selective Attention → Escape...

REVIEW: Pain, stress, memory and aversive learning

- Chronic pain is essentially a form of continuous emotional learning, reduced opportunity for forgetting, with the chronic pain state reflecting a shift from sensory to emotional & reward brain circuitry (Farmer et al, 2012)
- The brain continually encodes pain-related memories and constructs aversive associations (Mutso et al, 2014) creating ongoing stressor and feeding into fear-avoidance

This is bad...
Really BAD!!!
Flexion is dangerous!
A very bad idea
My back!
I'm doing more damage...
It hurts even when I think about lifting or see someone bend

Conditioned Stimuli
Unconditioned Stimuli
PAIN
Interrupt
Selective Attention
Escape...
Conditioned Responses
Unconditioned Responses
Fear
Avoidance
Safety-seeking
Exposure
Extinction of pain related fear

Update: Fear-Avoidance Model
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Conditioned Stimuli
Unconditioned Stimuli

PAIN Interrupt Selective Attention Escape...

Unconditioned Responses
Conditioned Responses

Extinction of pain related fear

Interference
Fear Avoidance Safety-seeking

Update: Fear-Avoidance Model

Manual therapy

• “Lie here while I fix this positional fault... your facet is really stuck! Now when you go home, don’t sit too long, look down for more than 5 minutes, sneeze or lift more than 10 pounds for a few days or it might go out again.”

• “This technique will help relax the muscle to allow better movement and turn down the sensitivity of your alarm... but the cool part is I can teach you an even more powerful technique you can do at home.”

Now apply this to intervention...
“...evaluation of sleep habits should be considered fundamental in the context of rehabilitation and should be included as part of the clinical history of each patient attending physical therapy.”

Let your walls do some of your work...

A brain that feels extremely threatened, confused, hopeless...

A brain that understands, is less threatened and has hope...

GET WELL SOONER
Staying active is better for your back.
Pain Neuroscience Education Recap

- Pain is a complex, multi-system output based upon threat appraisal
- If you can explain it, and do it well: patients learn to understand their pain, are less fearful of it, move better function better and hurt less (make the unknowns known)
- PNE should be coupled with goal setting, sleep hygiene, exercise (incorporating graded exposure concepts) and appropriate manual therapy for best effectiveness

ALL individuals have an untapped potential for improvement

Herman Kabot, MD, PhD

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stephen.g.schmidt@kp.org
linkedin.com/in/stephenschmidtpt

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