

Update on Functional Movement Disorders

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Disclosures

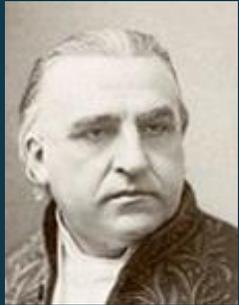
- No conflicts of interest to disclose
- The content of this presentation does not represent the views of the U.S. Department of Veterans Affairs or the United States Government

Goals

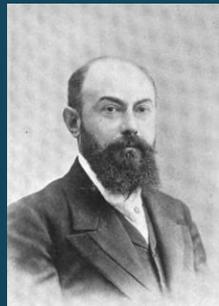
- A whirlwind 30-minute tour of:
 - What a functional movement disorder (FMD) is, and is not
 - Advances in our understanding of FMD pathophysiology
 - FMD etiology: Predisposing, Precipitating, & Perpetuating factors
 - How FMD pathophysiology informs diagnosis and treatment
 - A transdisciplinary treatment approach to FMD

A Clinical Lesson at the Salpêtrière
(Une leçon clinique à la Salpêtrière, André Brouillet, 1887)



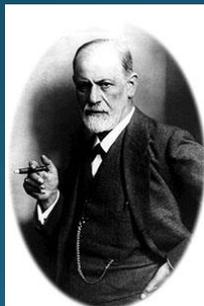


Hysteria
Charcot (1825-1893)

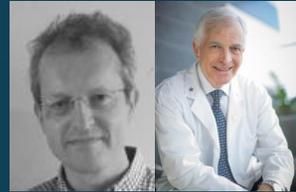


Dissociative D/O
Janet
(1859-1947)

Conversion D/O
Freud
(1856-1939)



**Psychogenic
Neurological D/O**
Fahn/Olanow/
Jankovic/ Others
2000s



**Functional
Neurological D/O**
Stone/Lang/
Edwards/LaFaver/
Others
~2013 to present



Edwards MJ, Stone J, Lang AE. From psychogenic movement disorder to functional movement disorder: it's time to change the name. *Mov Disord* 2014;29:849-852.

Fahn S, Olanow CW. "Psychogenic movement disorders": they are what they are. *Mov Disord* 2014;29:853-856.

What is an FMD?

- “A movement disorder that is:
 - Significantly altered by distraction or non-physiological maneuvers (including dramatic placebo response)
 - Clinically incongruent with movement disorders known to be caused by neurological disease”

Edwards et al. *Curr Opin Neuro*. 2013 Aug; 26(4): 442–447.

- “Functional motor disorder (FMD) can be defined as neurological symptoms affecting movement that are caused by loss of control or agency over movement, rather than a structural disease process.”

Nielsen et al. *BMC Neurol*. 2019; 19, 242.

- DSM 5 criteria for Conversion Disorder (Functional Neurological Symptom Disorder) no longer requires temporal relationship between psychological factors and the onset of neurological symptoms

Examples of positive “rule-in” signs of FMD/functional limb weakness

- **General signs**

Distractibility

Variability (e.g., difference in symptom severity between history taking and examination)

Suggestibility

- **Gait**

Dragging monoplegic gait

Knee buckling

Noneconomic posture

- **Tremor**

Variability

Distractibility

Entrainment

Spread of tremor to another body part if the tremor is restrained (“Whack a Mole” sign)

- **Jerks**

Predominantly axial

Distractibility

Variability

- **Parkinsonism**

Excessive slowness without loss of amplitude

Increased tone without cogwheel rigidity

Concurrent functional tremor

- **Dystonia**

Fixed posture (typically hand flexion with sparing of digits 1 and 2 or fixed ankle inversion)

Lack of sensory trick/geste antagoniste

- **Tics**

No voluntary suppression

No or atypical/incomplete premonitory urge

Movements not stereotypical

- **Weakness**

Hoover sign/hip abductor sign

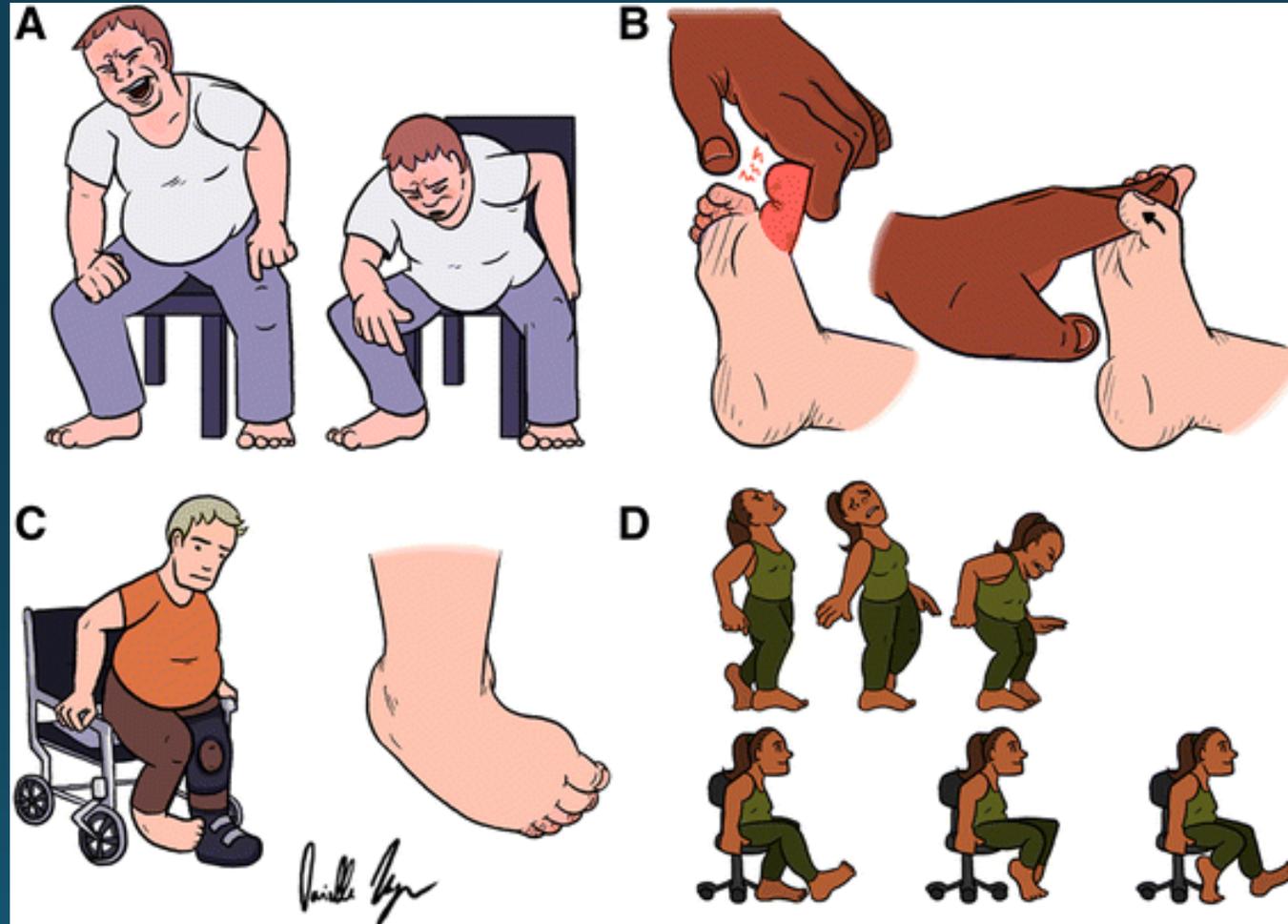
Spinal Injuries Center sign

Asymmetry of head rotation

Arm drift without pronation

Giveway/collapsing and/or global pattern of weakness

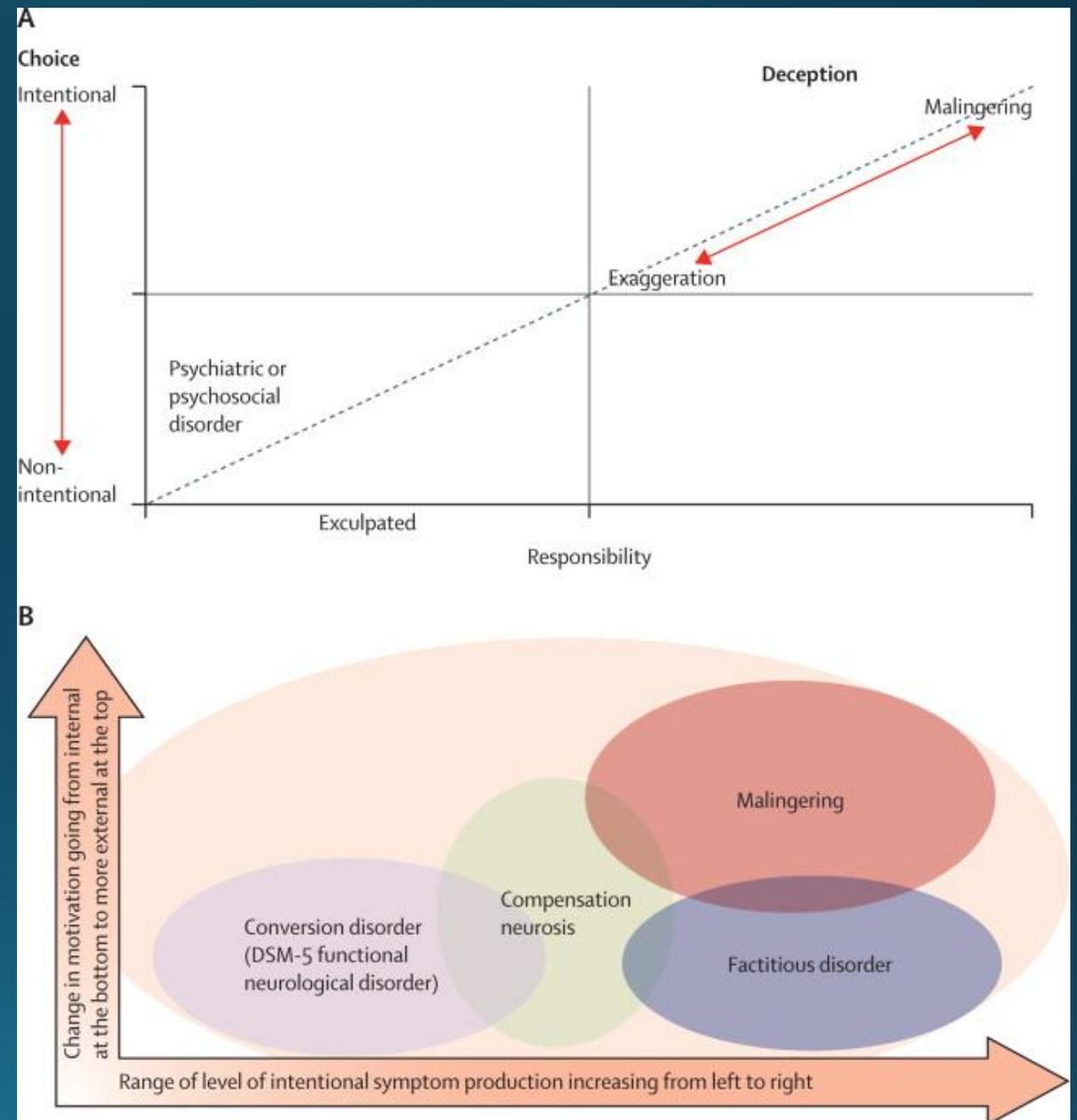
Functional Gait



What FMD is not...

“Functional
Neurological Disorder is
REAL...and NOT
imagined.”

Professor Jon Stone, Edinburgh.
www.neurosymptoms.org
(patient education website)



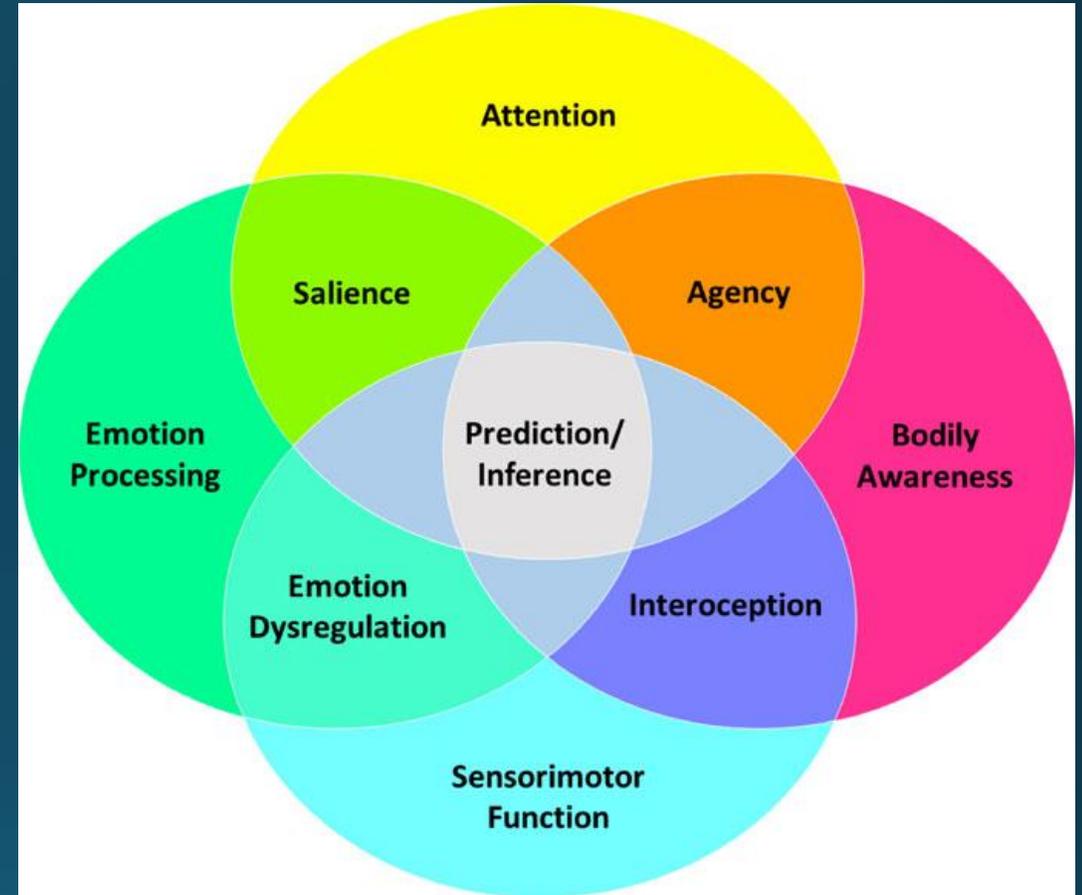
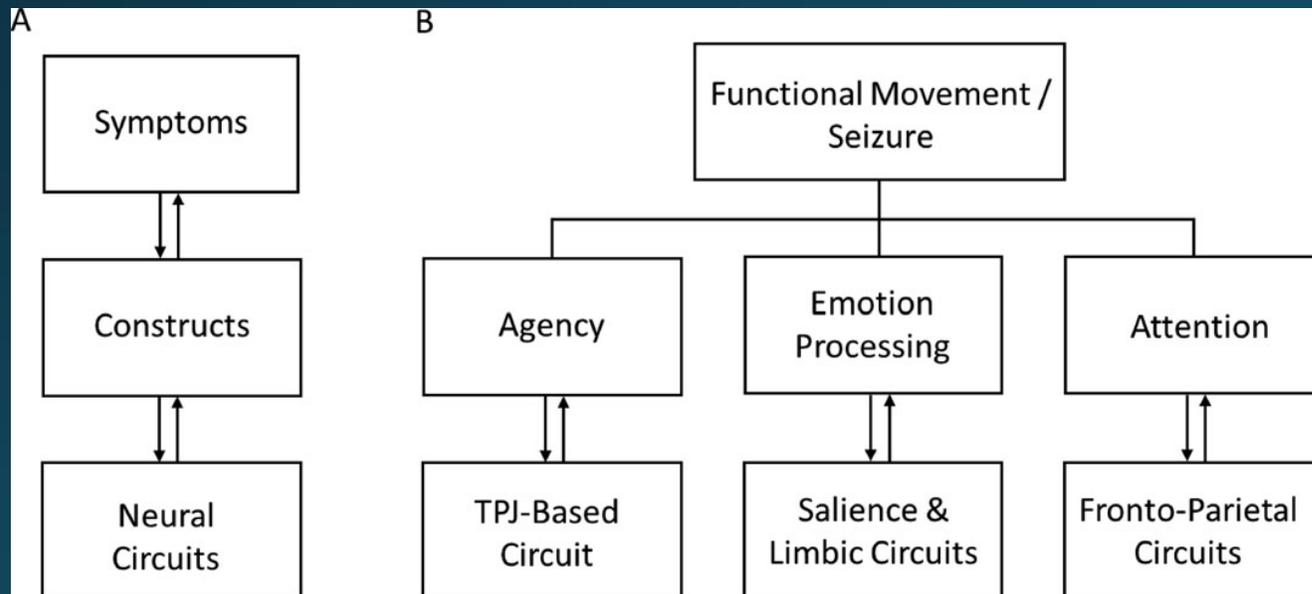
So *WHY* do some people develop FMDs and others do not?

HOW do those with FMD experience movements that appear voluntary as involuntary?

WHAT should we say and do to help patients with FMD?

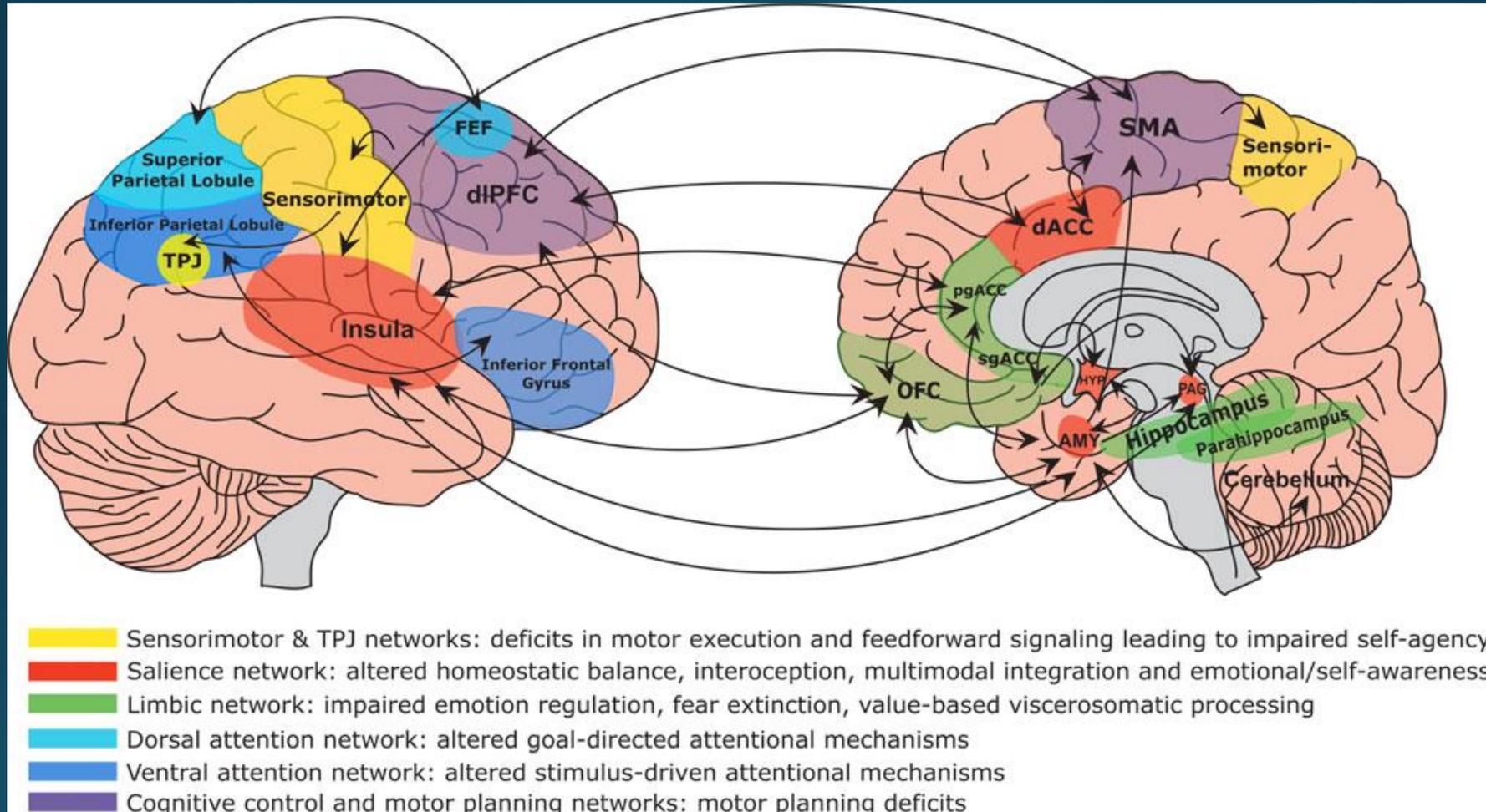
How?

Abnormalities of several constructs (and their associated neural circuits) can interact in different ways to produce symptoms and observable signs of FND.

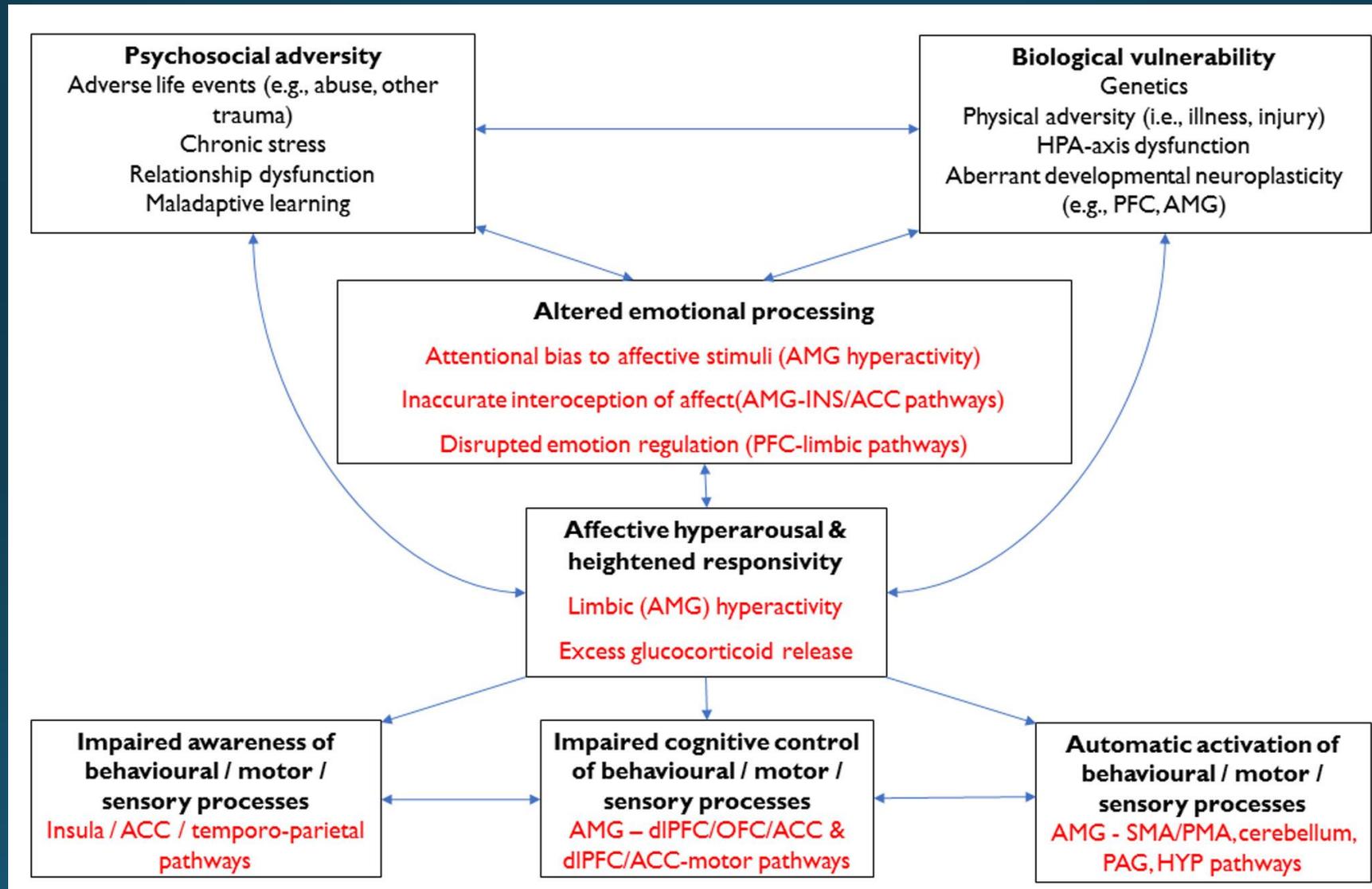


Drane DL, Fani N, Hallett M, Khalsa SS, Perez DL, Roberts NA. A framework for understanding the pathophysiology of functional neurological disorder. *CNS Spectr.* 2020 Sep 4:1-7.

Display of brain circuits (and related constructs) that are emerging as important in the pathophysiology of FND



Emotion Processing



Pick et al. *J Neurol Neurosurg Psychiatry*. 2019;90(6):704–711.

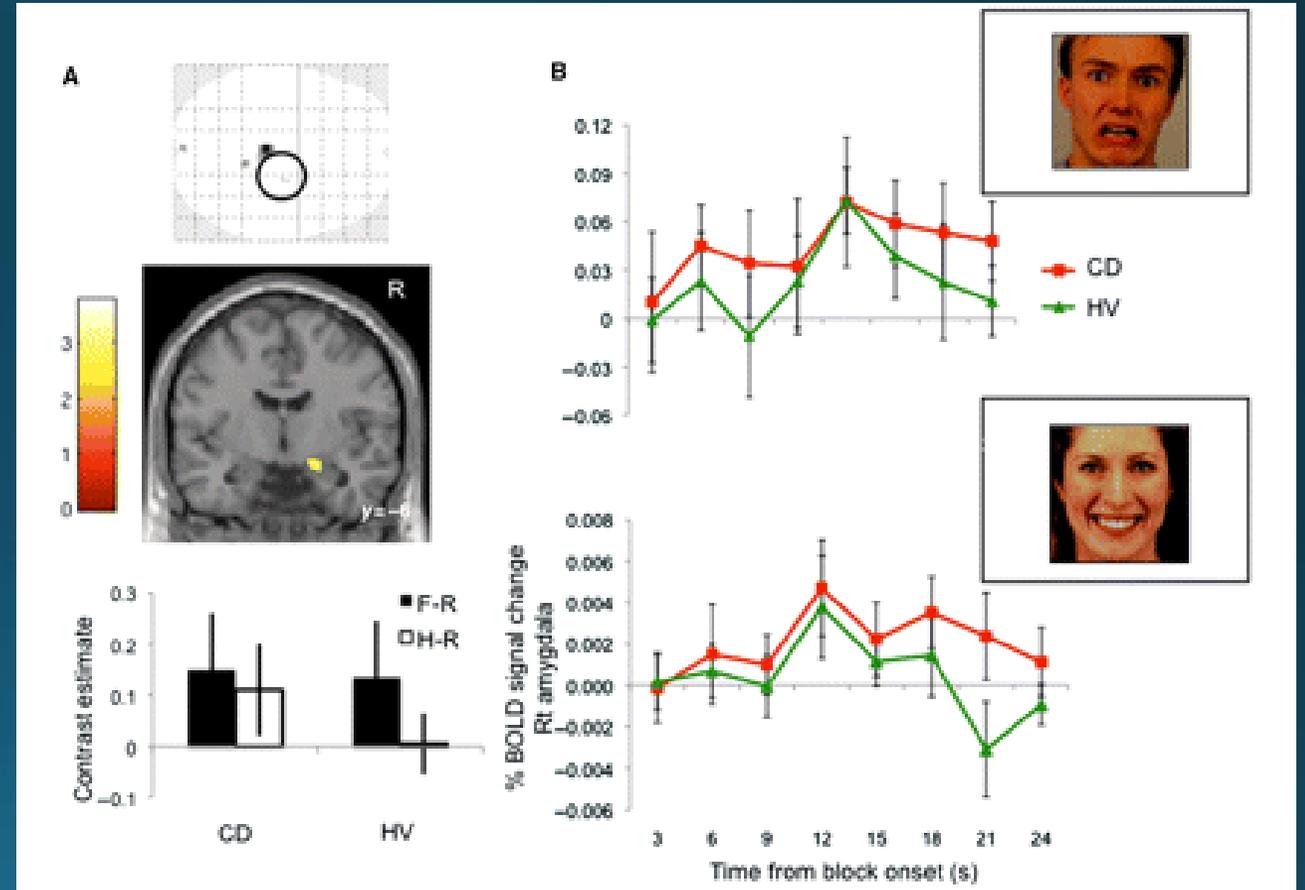
Emotion Processing

FND shown to experience:

- Increased emotional reactivity
- Heightened arousal and avoidance
- Impaired top-down emotion regulation
- Amplification of FND sx during negatively valenced or psychologically-threatening mood states
- Deficits in emotional awareness/alexithymia
- Aberrant salience processing
- Errant activation of learned/innate defensive responses

Pick et al. *J Neurol Neurosurg Psychiatry*.
2019;90(6):704–711.

Amygdala activity to emotional stimuli in conversion disorder (CD).

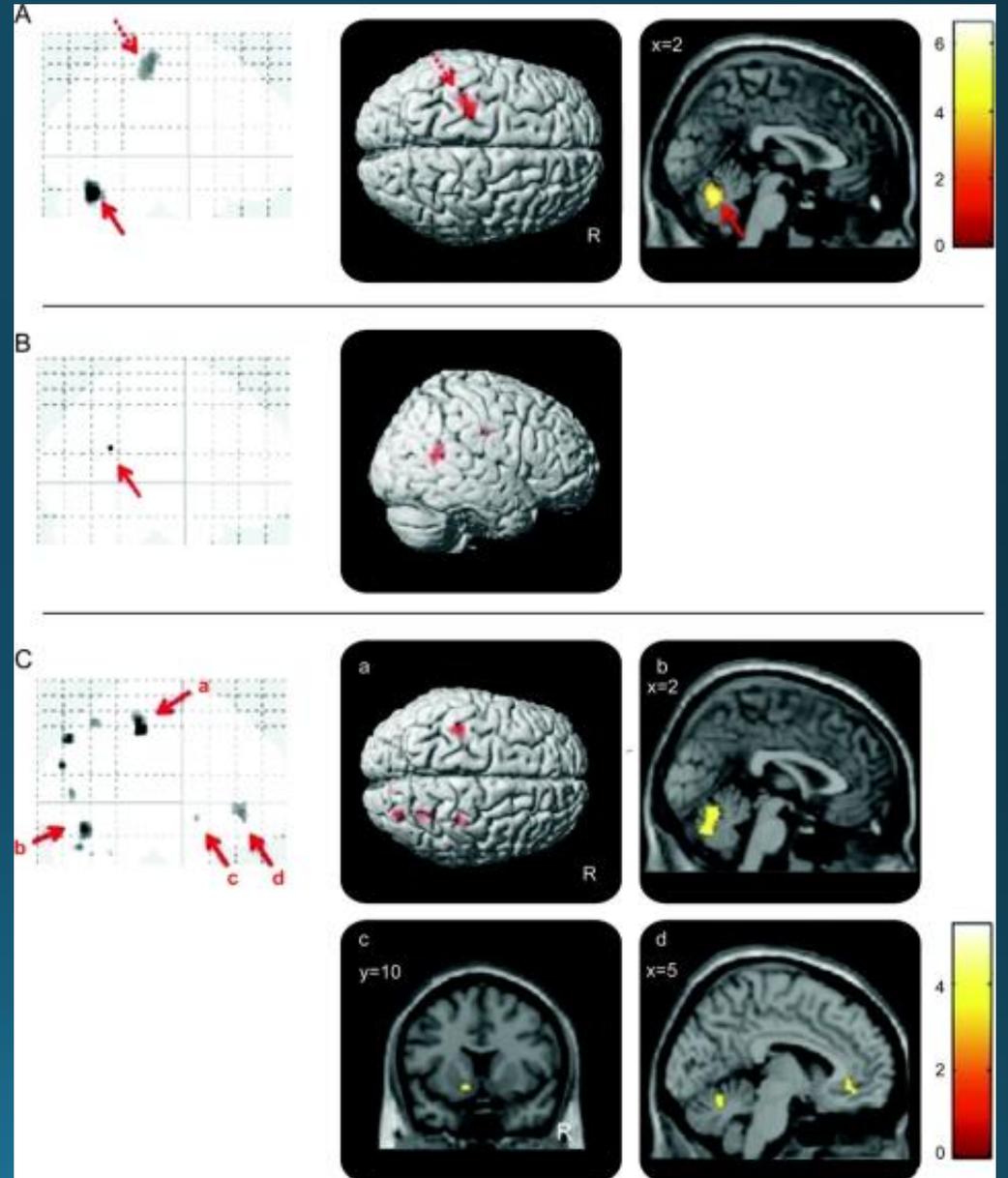


Voon et al. *Brain*, Volume 133, Issue 5,
May 2010, Pages 1526–1536,

Self Agency

Ability to exert and perceive control over one's own actions

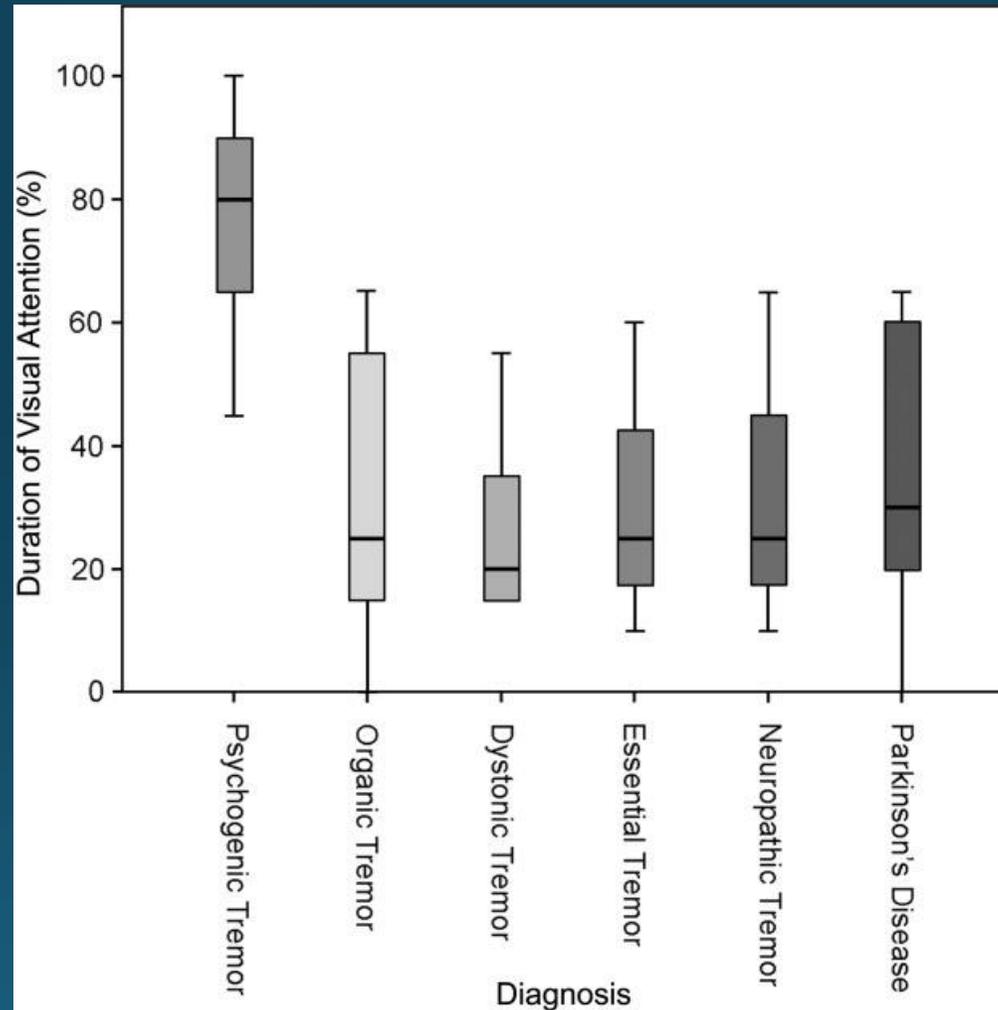
- When a movement is generated:
- The rest of the brain is notified by a feedforward signal.
 - When movements happen, there is feedback through various sensory experiences about the movement.
 - If the feedback matches the feedforward, then there is a sense of causality and self-agency.
-
- Impaired in FMD



Attention

Attention to self in psychogenic tremor

Mean percentage of visual attention for patients with psychogenic tremor and organic tremor



van Poppelen et al., 2011.
Attention to self in psychogenic tremor. *Mov. Disord.* 26, 2575–2576.

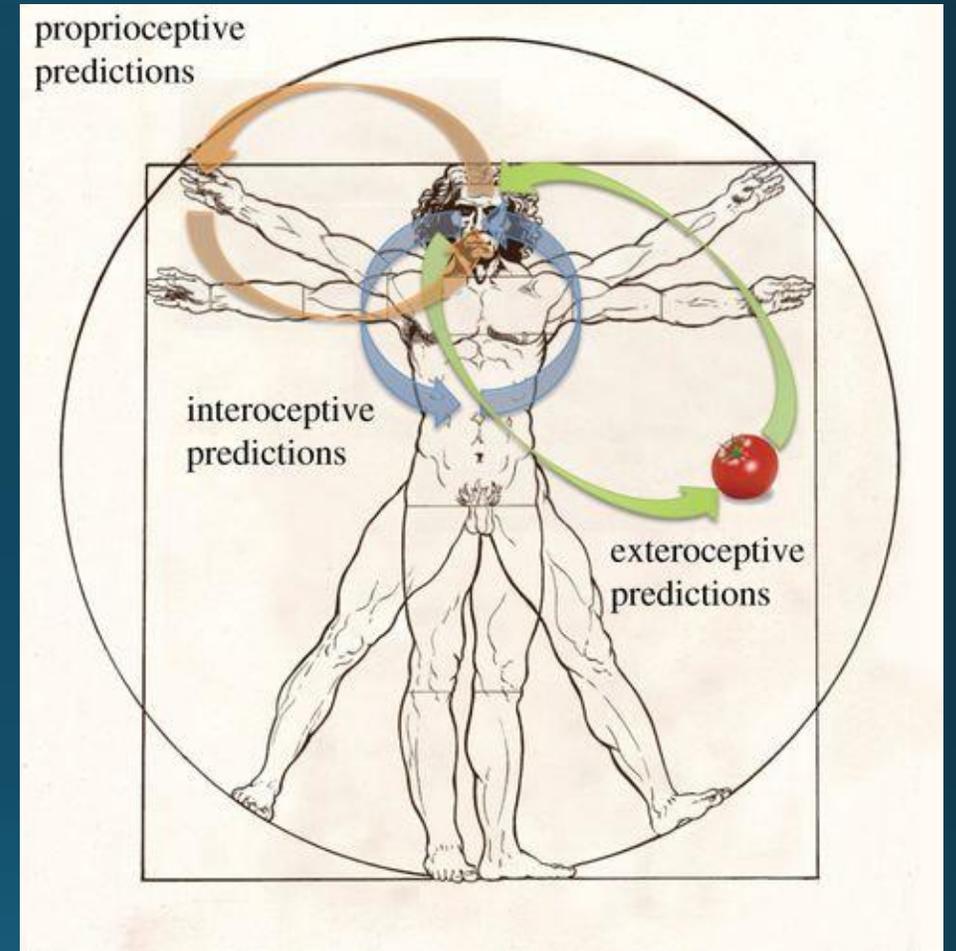
Interoception

- “the process by which the nervous system senses, interprets, and integrates signals originating from within the body, providing a moment-by-moment mapping of the body’s internal landscape across conscious and unconscious levels.”

Drane et al. *CNS Spectr.* 2020 Sep 4:1-7.

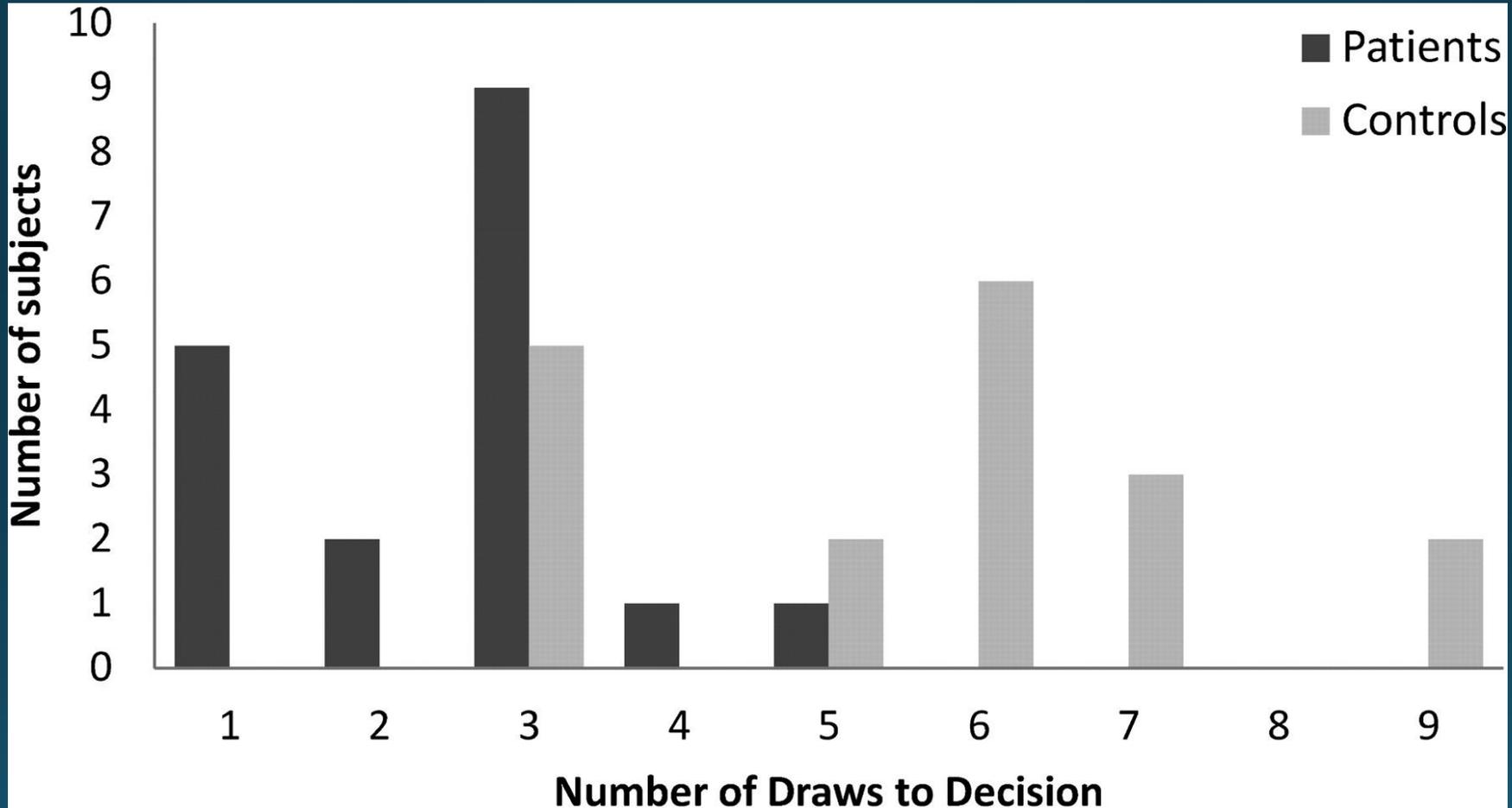
- Shown to be impaired in FND
- Impaired interoception related to dissociation in FND

Pick et al. Dissociation and interoception in functional neurological disorder, *Cognitive Neuropsychiatry*. 2020; 25:4, 294-311.



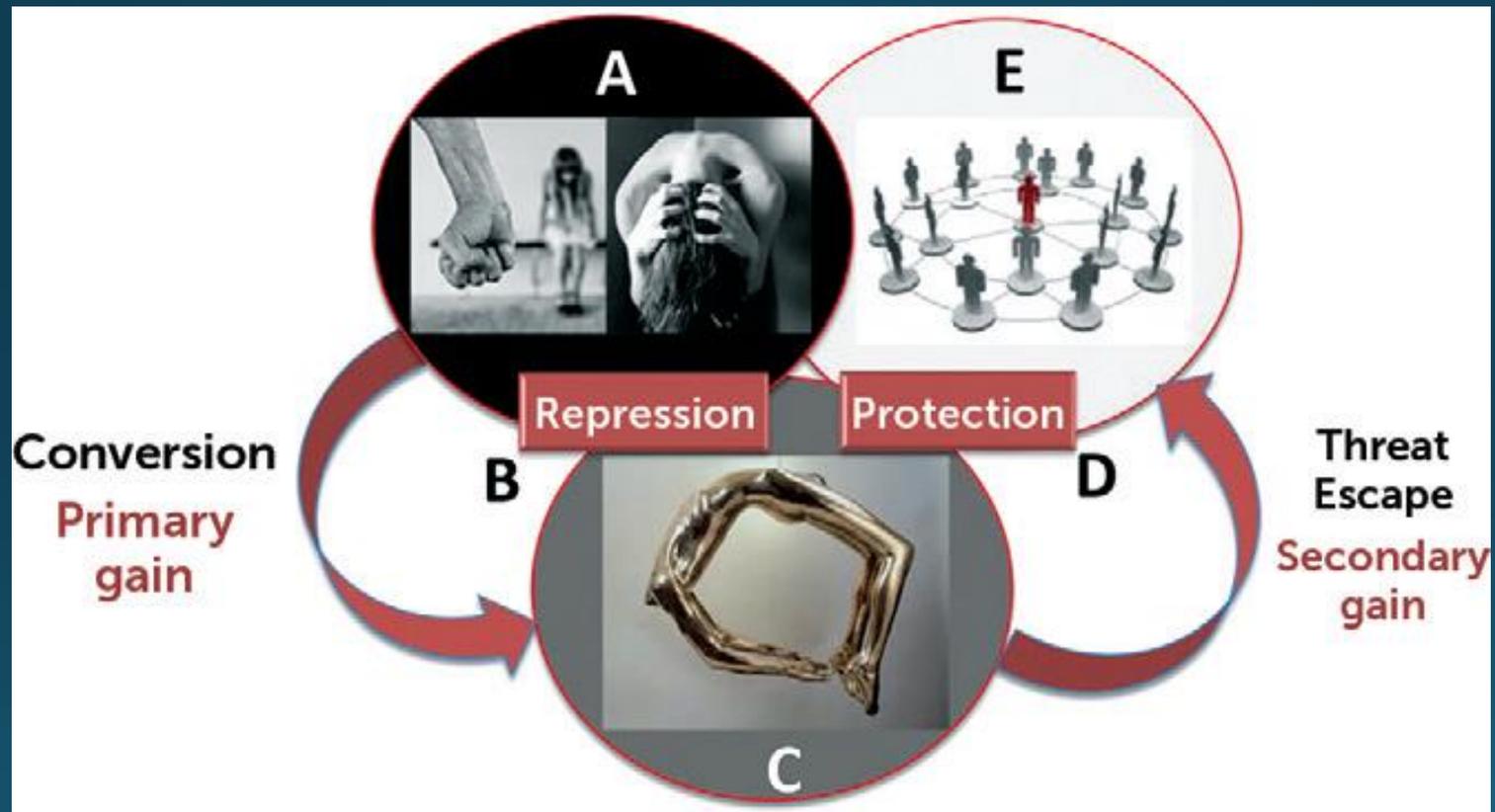
Seth AK, Friston KJ. Active interoceptive inference and the emotional brain. *Philos Trans R Soc Lond B Biol Sci*. 2016 Nov 19;371(1708):20160007.

Perceptual Inference & Predictive Processing



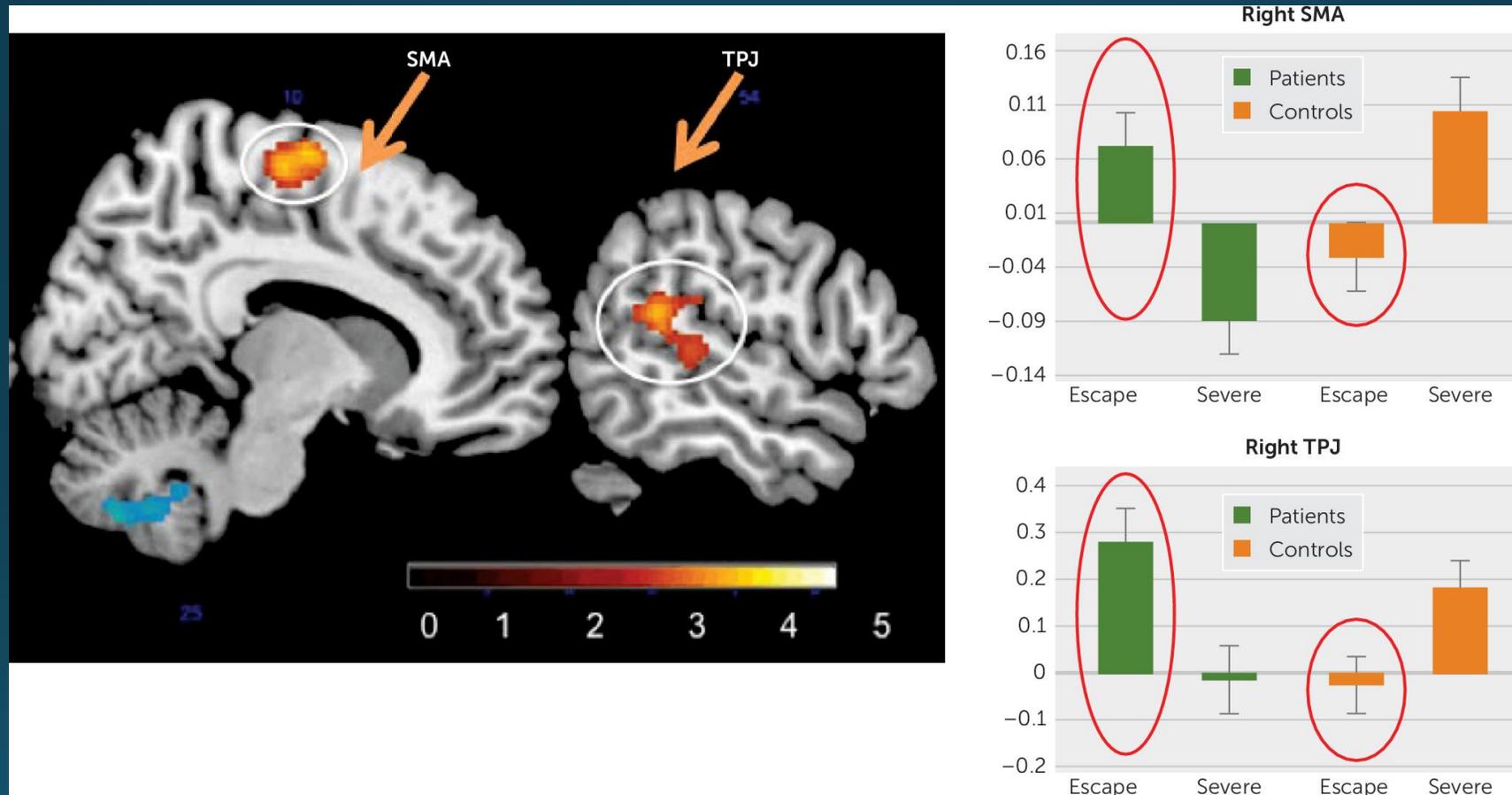
Number of draws to decision for patients and controls

Schematic illustration of the psychodynamic conversion model



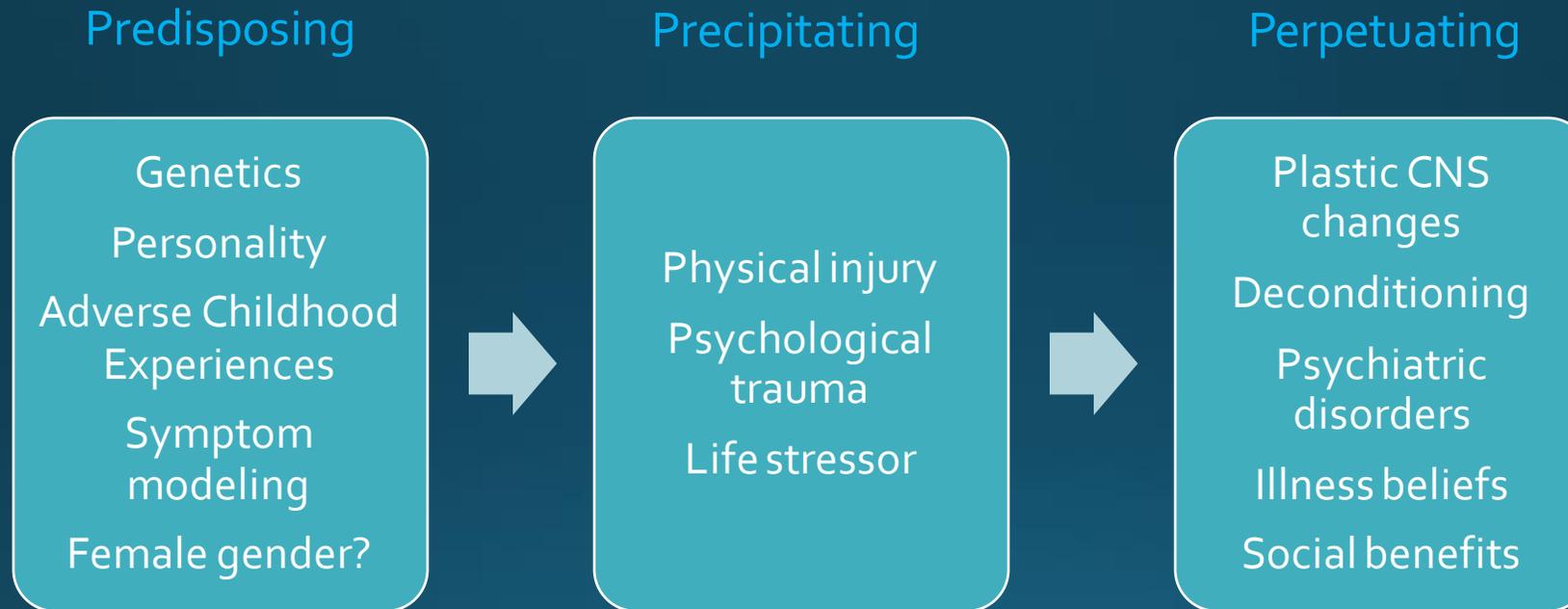
Cretton A, Brown RJ, LaFrance WC, Jr., Aybek S. What Does Neuroscience Tell Us About the Conversion Model of Functional Neurological Disorders? *J Neuropsychiatry Clin Neurosci.* 2019; 2020 Winter;32(1):24-32.

A putative neural signal of a “conversion” process in functional neurological disorders



Aybek S, Nicholson TR, Zelaya F, et al: Neural correlates of recall of life events in conversion disorder. *JAMA Psychiatry* 2014; 71:52–60

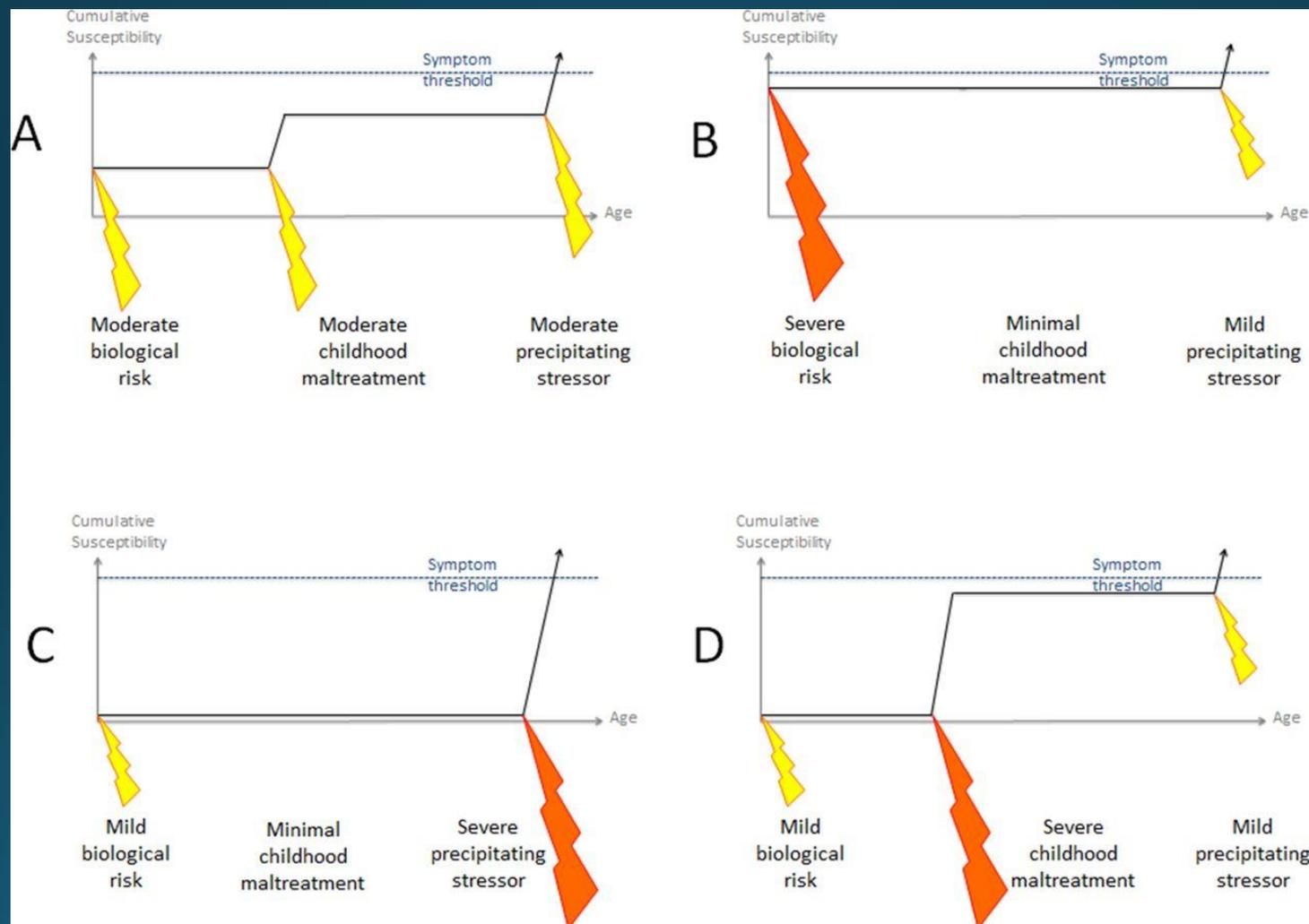
FMD Etiology: Why?



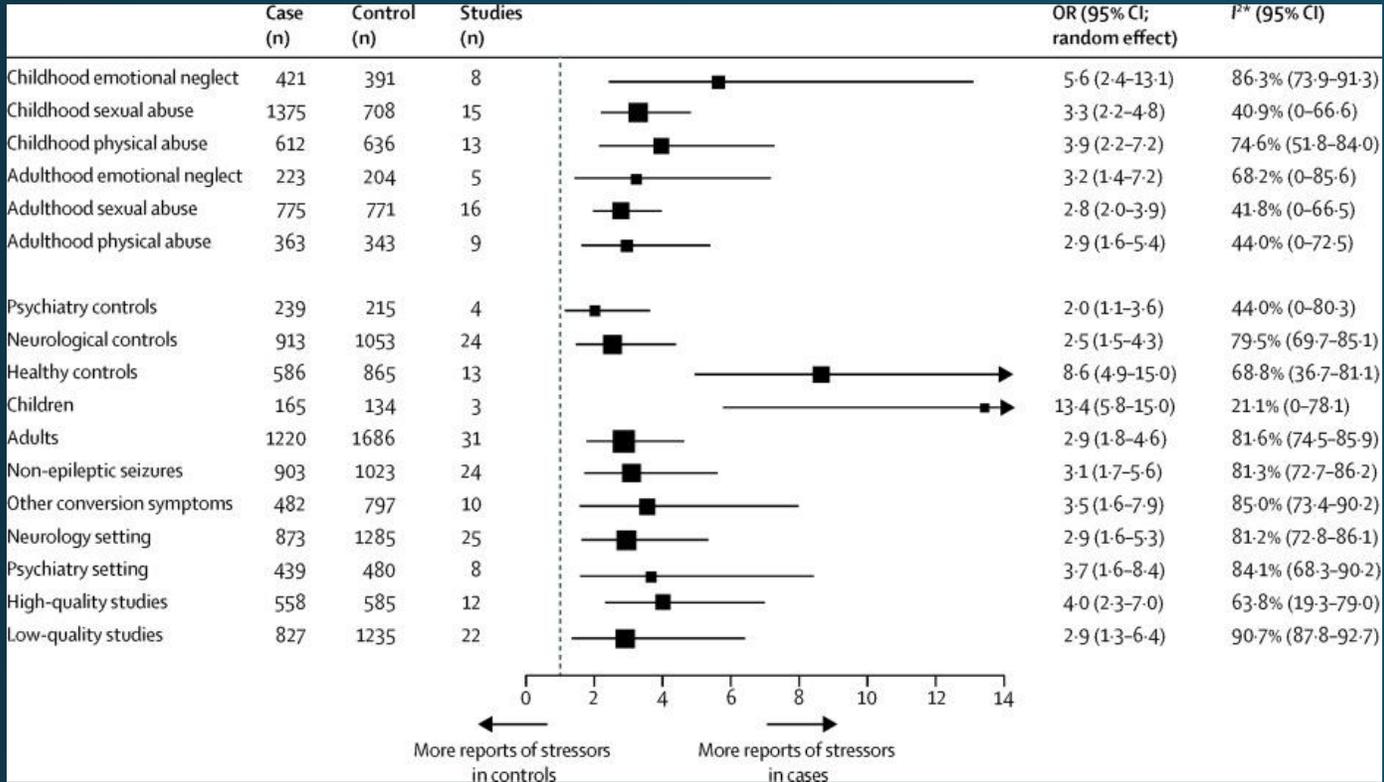
- Stress vs Stressor
- “Trauma-mediated aberrant neuroplasticity”
(Perez et al. J Neuropsychiatry Clin Neurosci. 2018 Fall; 30(4): 271–278.

Why?

A stress-diathesis model of FND



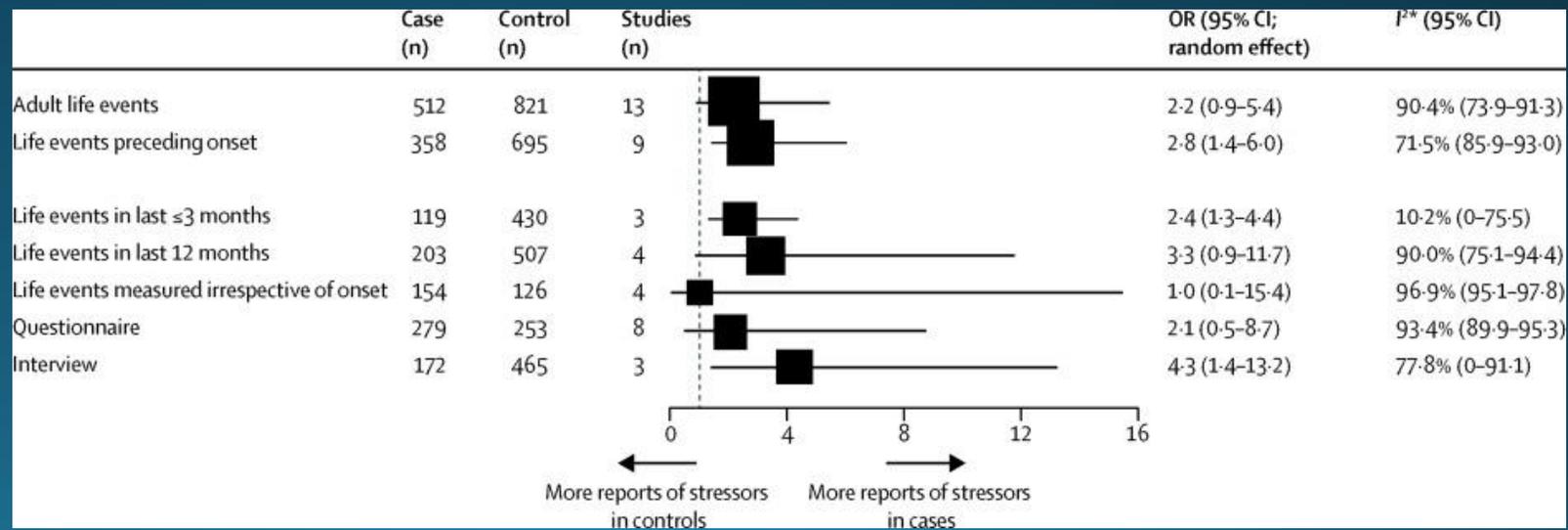
Keynejad et al. *J Neurol Neurosurg Psychiatry* 2019;90:813-821.



Ludwig et al. Stressful life events and maltreatment in conversion (functional neurological) disorder: systematic review and meta-analysis of case-control studies. *Lancet Psychiatry*. 2018 Apr;5(4):307-320.

Figure 1: Summary of meta-analysis of stressors in childhood and adulthood in conversion (functional neurological) disorder including subgroup analyses

Figure 2: Summary of meta-analysis of adult stressful life events in conversion (functional neurological) disorder including sensitivity analysis by nature and duration of life event period assessed



Diagnosis

- Take the patient seriously
- Give the problem a diagnostic label
- Explaining the rationale for the “rule-in” diagnosis
 - Demonstrate positive exam signs
- Some discussion of HOW symptoms arise
 - i.e. hardware versus software analogy, pathophysiological mechanisms may be useful
- Emphasis on reversibility and effective triage for treatment; Retraining

“Disorder of Communication”

- Aberrant communication at many levels:
 - Disordered messaging between brain, mind and body that results in functional movement symptoms
 - FMD symptoms as communication of embodied distress
 - Difficulty recognizing maladaptive thoughts and communicating emotion (alexithymia)
 - Often a breakdown of healthy communication in interpersonal (and clinical/therapeutic) relationships
 - Tx process of guiding patient in acquiring healthy communication (language/thoughts/retraining of brain & body) skills to improve agency, emotional regulation, and function

CBT Formulation

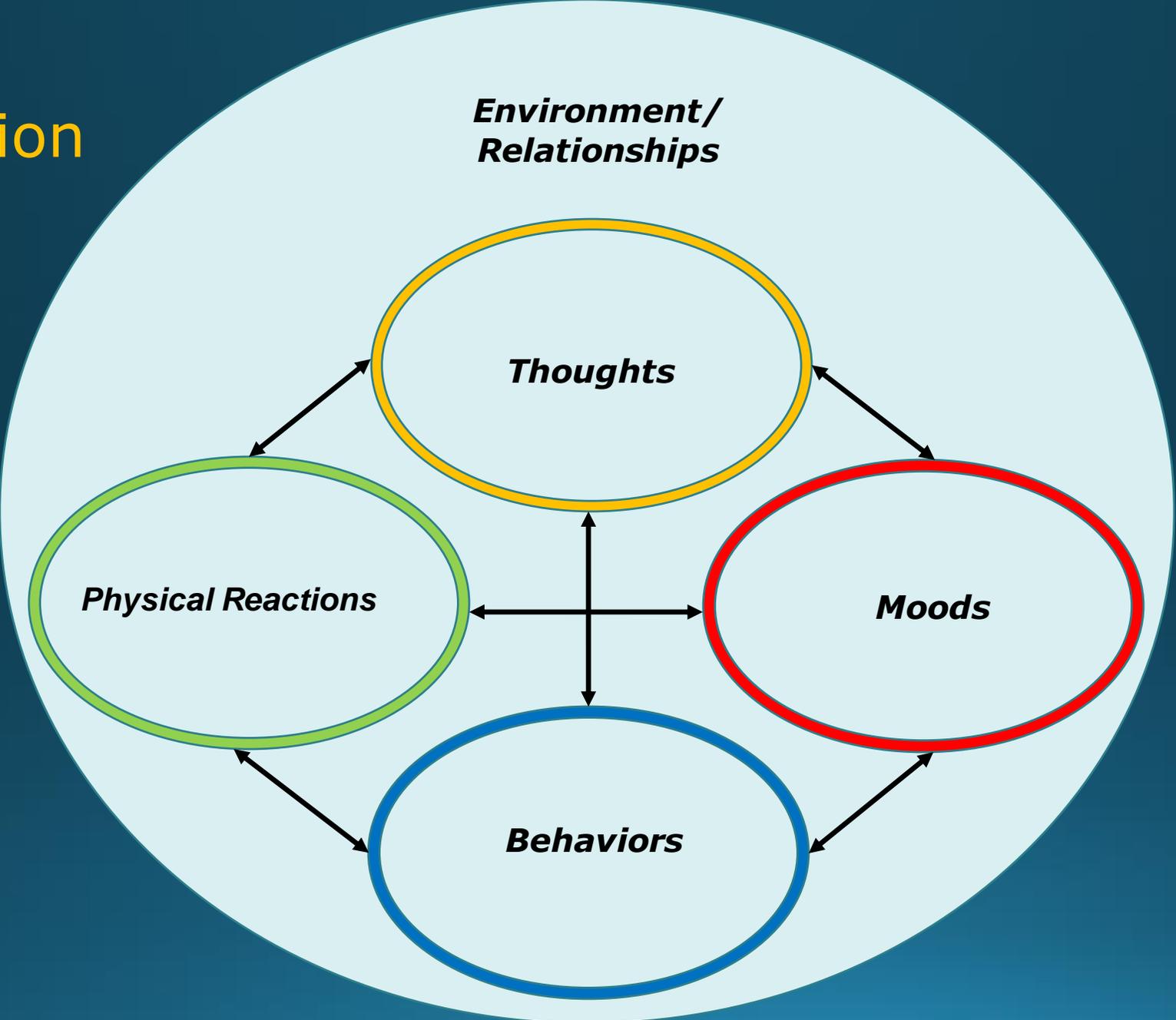
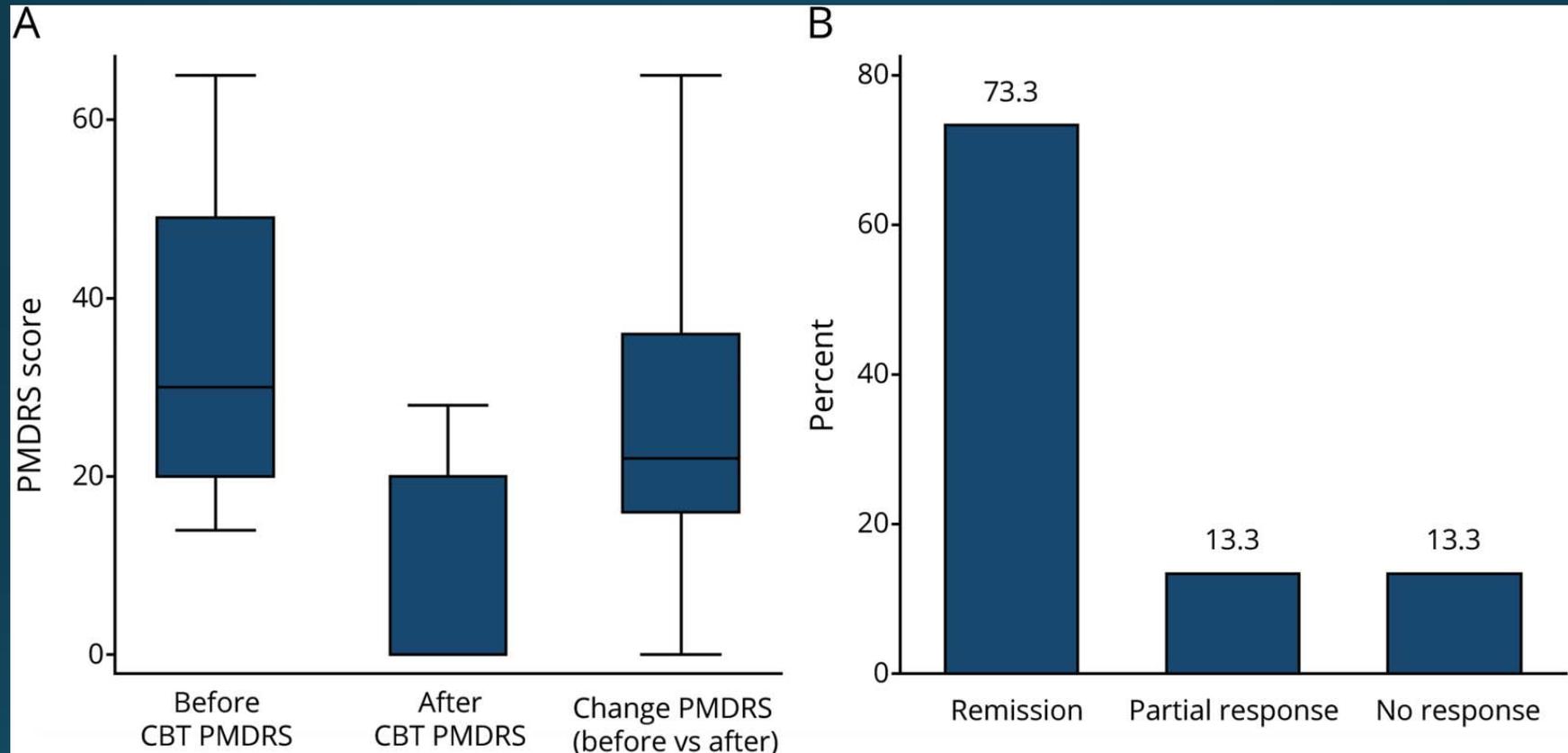


Figure 1: Clinical changes after CBT



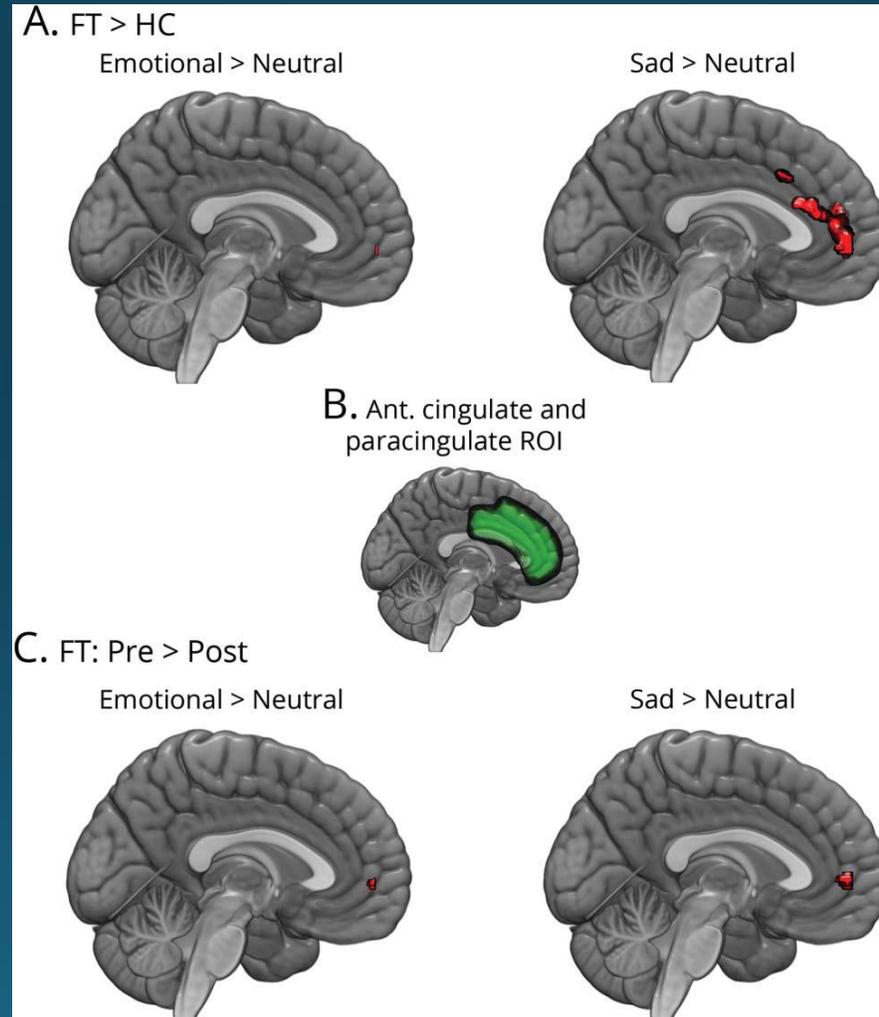
(A) Box-whisker plots visually summarize the distribution of responses before and after CBT

(B) Distribution of response categories based on change in Rating Scale for Psychogenic Movement Disorders (PMDRS) score after CBT.

Figure 2: Differences in fMRI activation for the basic-emotion task

(A) Differences between participants with functional tremor (FT) and healthy controls (HCs). Regions in red showed greater activation in FT.
(B) Region over which small volume correction was implemented.

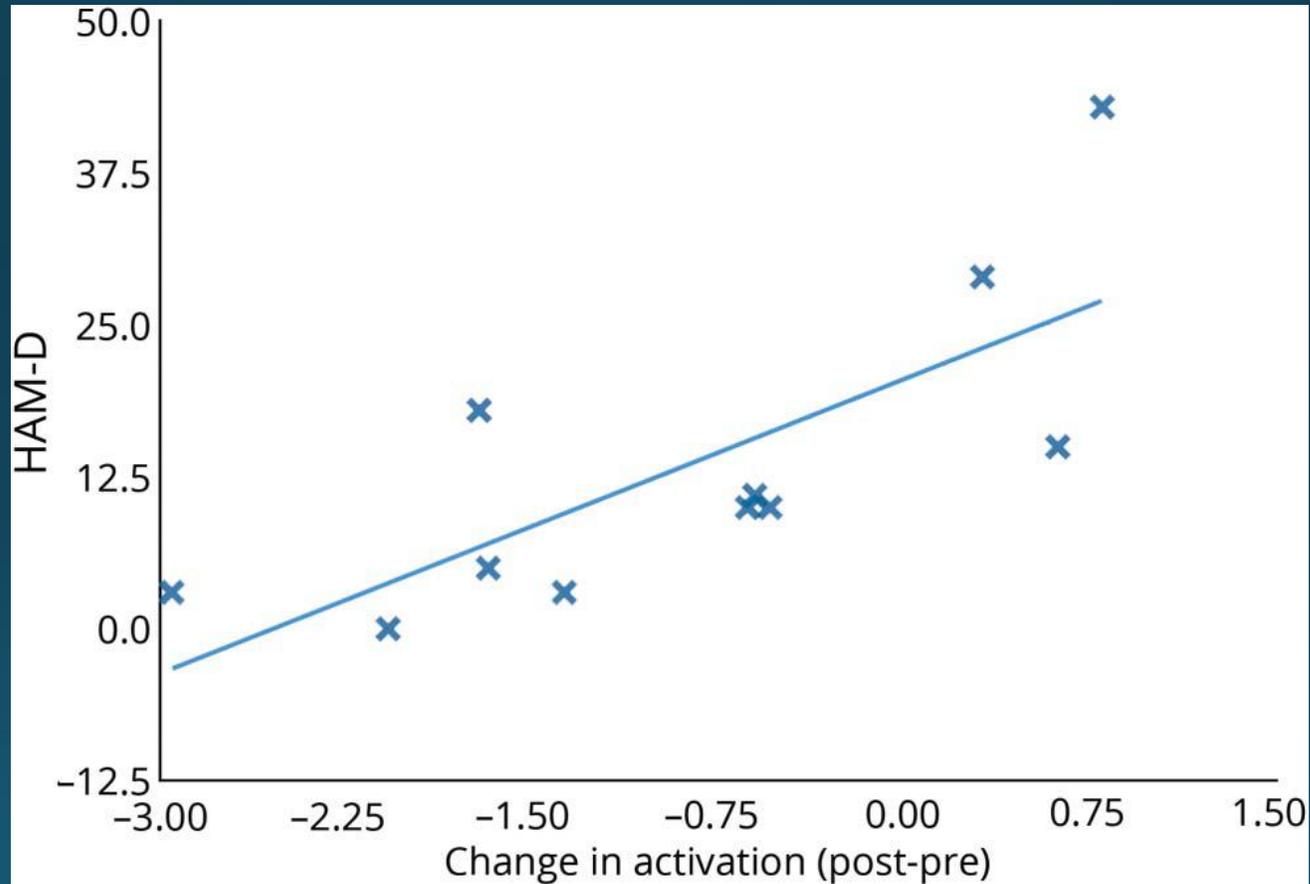
(C) Changes from before CBT to after CBT in patients with FT. Regions in red showed greater activation before CBT that decreased after CBT. ROI = region of interest.



Espay et al. *Neurology*.
2019;93(19):e1787-e98.

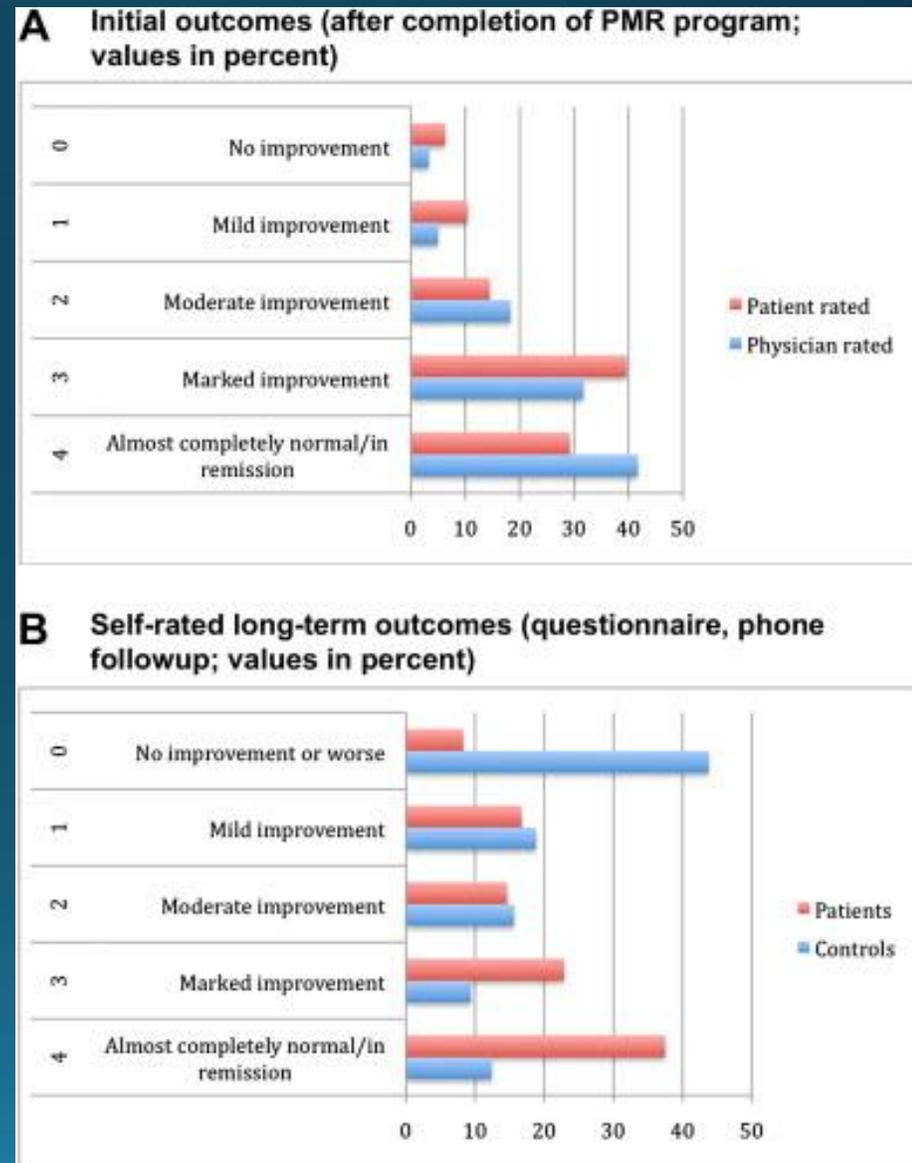
Figure 4: Changes in activation and depression scores

A strong correlation was found between Hamilton Depression Scale (HAM-D) scores and changes in activation, before cognitive behavioral therapy to after CBT, in the anterior cingulate/paracingulate region ($r^2 = 0.56$, $p = 0.008$) among those patients with FT who responded to CBT therapy.



Physiotherapy Tx- Czarnecki et al., 2012 (Mayo Clinic)

- 60 consecutive pts with FMD vs 60 historical matched FMD controls w/o PT
- Outpatients PT twice daily for 5 consecutive days
- Focused on relearning normal motor programs
- At one week, 69% reported markedly improved or remission
- At two years, 60% in intervention group better or in remission vs. 22% of controls



MOtor REtraining (MORE) for FMD

Jacob et al. *PM&R*,
10: 1164-1172.

- One-week, multidisciplinary inpatient treatment program with
- 32 consecutive FMD patients admitted to program
- Daily physical, occupational, speech therapy, and psychotherapy interventions
- At discharge, 86.7% of patients reported symptom improvement on the CGI
- Self-reported improvement was maintained in 69.2% at the 6-month follow-up.
- PMDRS scores improved by 59.1% from baseline to discharge.

Also see:

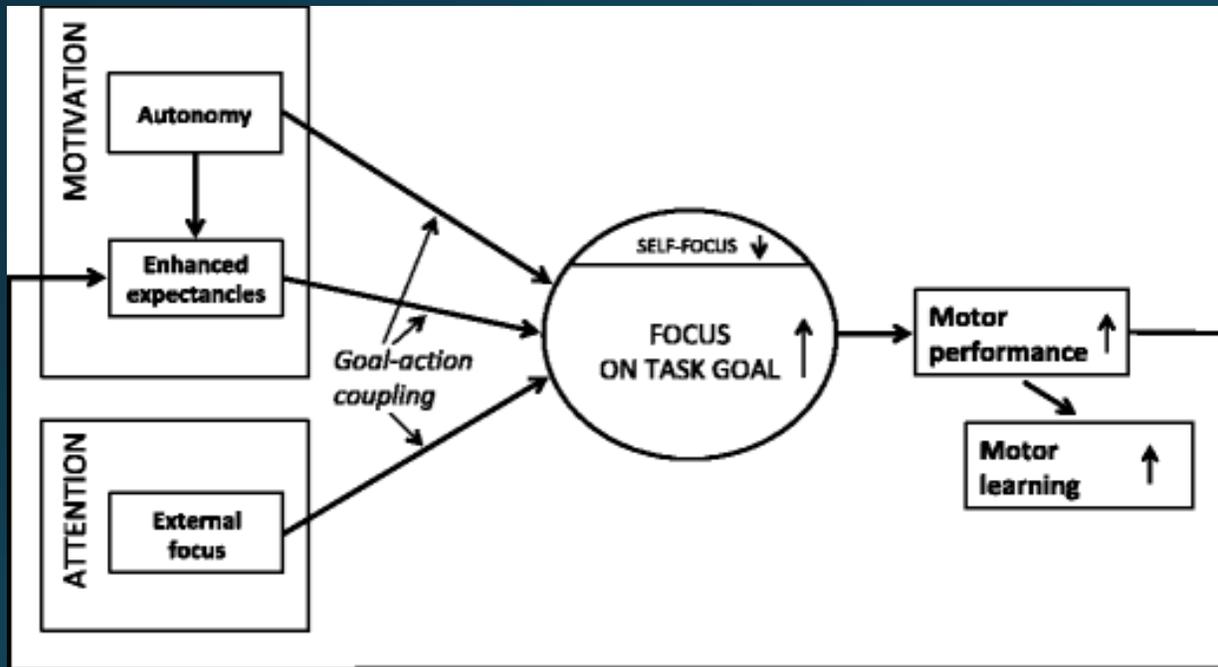
- Jordbru et al, *J Rehabil Med* 2014;46:181-7. (+ inpatient RCT for FMD)
 - Nielsen et al. *J Neurol Neurosurg Psychiatry* 2017;88:484-490.
- (+ five day randomized inpatient feasibility study now with ongoing RCT in UK- www.physio4fmd.org)

Physiotherapy principles in FMD

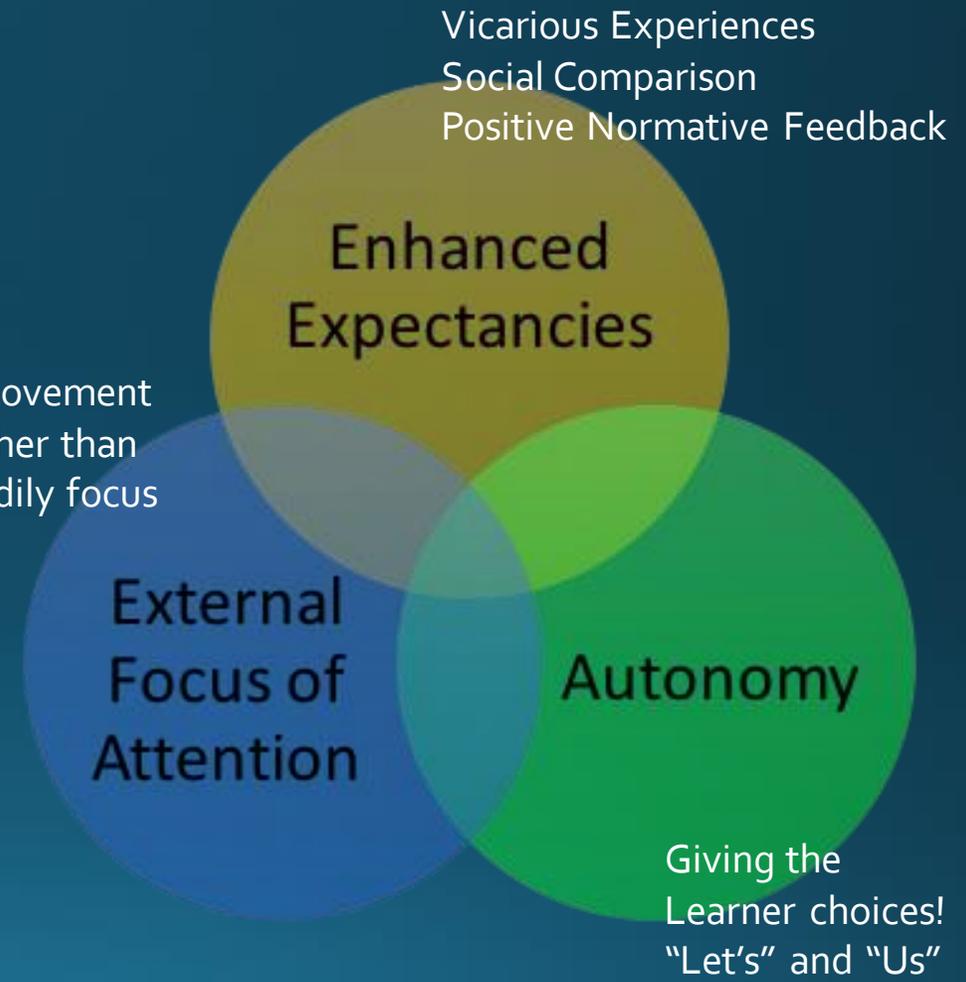
- Build trust before challenging/pushing the patient
- Project confidence making it clear that the physiotherapist knows about FMD
- Create an expectation of improvement
- Open and consistent communication between the multidisciplinary team and patient
- Involve family and carers in treatment
- Limited “hands-on” treatment. When handling the patient, facilitate rather than support
- Encourage early weight bearing. “On the bed strength” will not usually correlate with ability to stand in functional weakness
- Foster independence and self management
- Goal directed rehabilitation focusing on function and automatic movement (e.g. walking) rather than the impairment (e.g. weakness) and controlled (“attention-full”) movement (e.g. strengthening exercises)
- Minimise reinforcement of maladaptive movement patterns and postures
- Avoid use of adaptive equipment and mobility aids (though these are not always contra-indicated)
- Avoid use of splints and devices that immobilise joints
- Recognise and challenge unhelpful thoughts and behaviours
- Develop a self management and relapse prevention plan

Nielsen et al., 2014
(expert consensus)

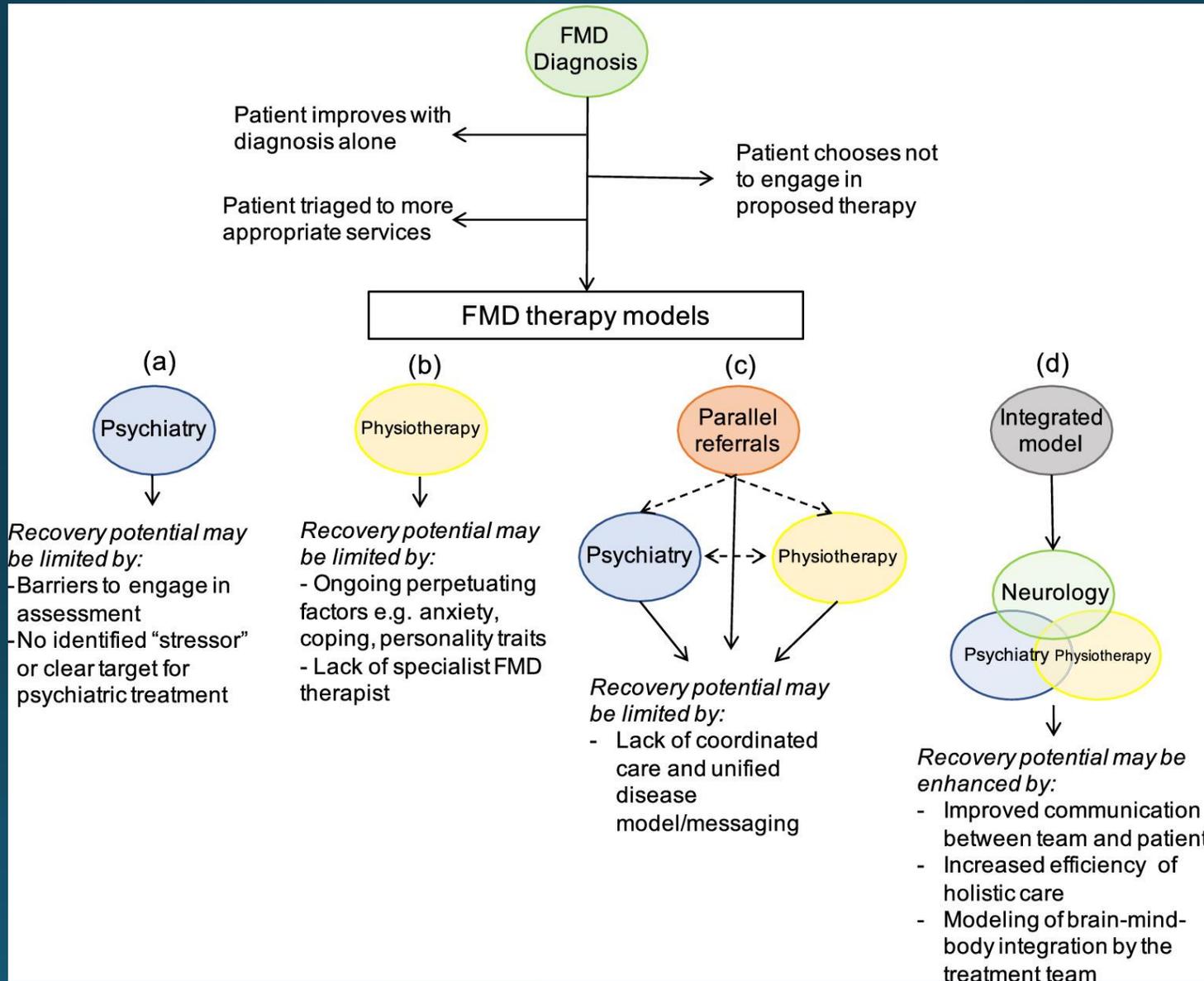
OPTIMAL Theory: Restoring Self Agency to Movement



Focus on movement GOALS rather than Internal bodily focus

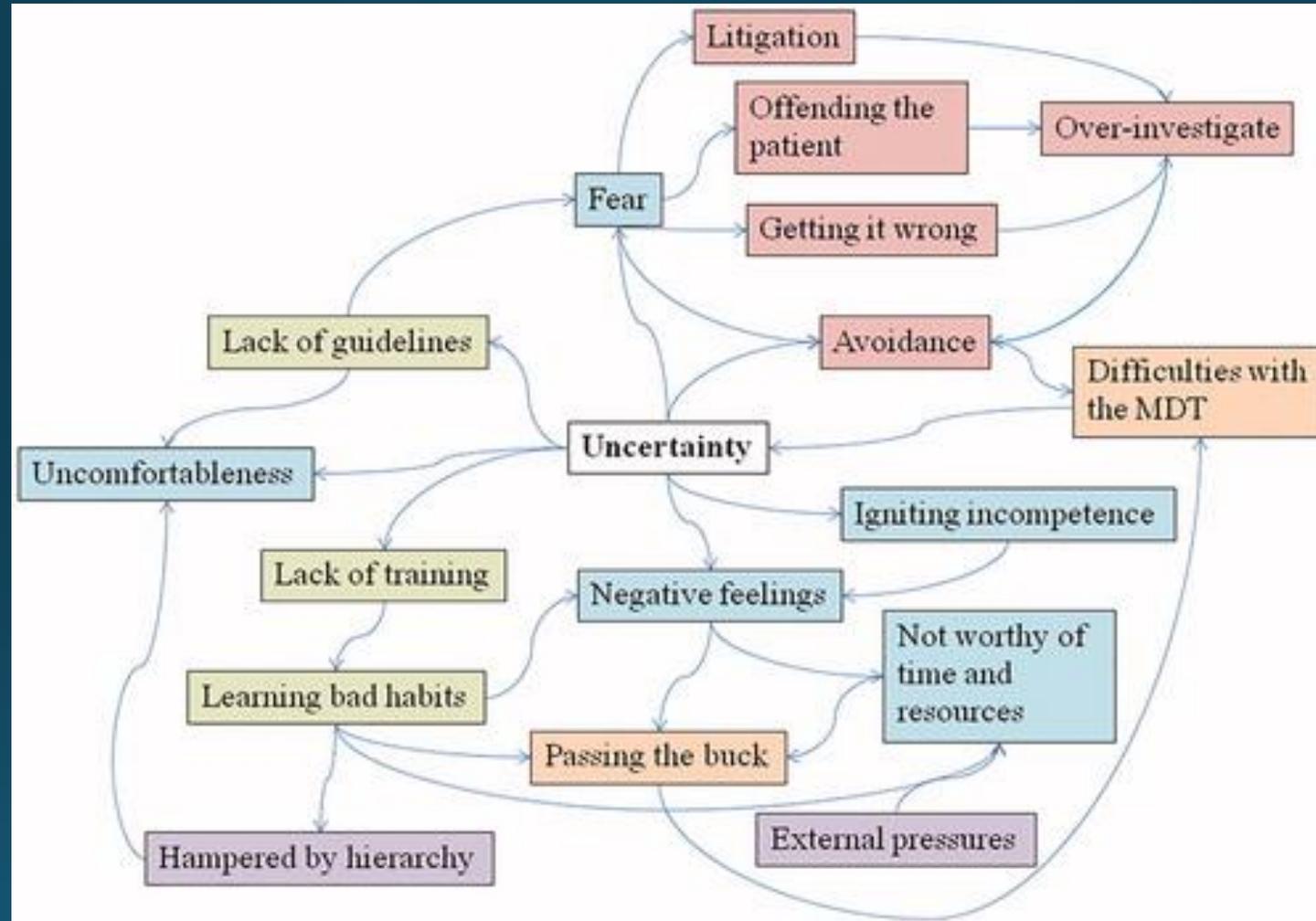


Integrated Therapy for FMD



Lidstone, S.C., MacGillivray, L. and Lang, A.E. (2020), Integrated Therapy for Functional Movement Disorders: Time for a Change. *Mov Disord Clin Pract*, 7: 169-174.

FMD Treatment Barriers



Barnett et al. The vicious cycle of functional neurological disorders: a synthesis of healthcare professionals' views on working with patients with functional neurological disorder. *Disability and Rehabilitation*, 2020.

Resources

- Functional Neurological Disorder Society (FNDS):
www.fndsociety.org
- www.neurosymptoms.org
 - Self Help website for patients with functional neurological disorder/symptoms
- www.fndhope.org
 - Patient-run “charitable organization promoting awareness and support for individuals and carers affected by Functional Neurological Disorder”
- Feel free to e-mail me directly at mack@ohsu.edu