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Functional Somatic Symptoms in Children and Adolescents: The Stress-System Approach to Assessment and Treatment

Kasia Kozłowska, Stephen Scher, and Helene Helgeland

Online Supplement 1.3

Further Reading: Annotated Supplemental Bibliography

Chapter 1. Introduction

Original References by Dr Kenneth Nunn Pertaining to the Mind-Body Program

Dr Kenneth Nunn set up the Mind-Body Program Nunn at the Royal Alexandra Hospital in 1994 in response to the presentation of children with functional paralysis of the legs (Nunn, 1998) (see pages 274–276 pertaining to conversion disorder) and pervasive refusal (Thompson and Nunn, 1997).

Nunn, K. (1998). Neuropsychiatry in Childhood: Residential Treatment. *In: Green, J. & Jacobs, B. (eds.) In-Patient Child Psychiatry; Modern Practice, Research and the Future*, London, Jessica Kingsley.

Thompson, S. L. & Nunn, K. P. (1997). 'The Pervasive Refusal Syndrome: The RAHC Experience'. *Clinical Child Psychology and Psychiatry*, 2, 145–165.

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Articles by Bruce Perry and Frank Putnam

These published works engraved on the first author’s mind the idea that developmental experiences – including those with attachment figures – help shape the organization and function of the developing body and brain.

Perry, B. D. & Pollard, R. (1998). ‘Homeostasis, Stress, Trauma, and Adaptation. A Neurodevelopmental View of Childhood Trauma’. *Child and Adolescent Psychiatric Clinics of North America*, 7, 33–51, viii.

Perry, B. D., Pollard, R. A., Blakley, T. L., Baker, W. L. & Vigilante, D. (1995). ‘Childhood Trauma, the Neurobiology of Adaptation, and “Use-Dependent” Development of the Brain: How “States” Become “Traits”’. *Infant Mental Health Journal*, 16, 271–291.

Putnam, F. W. (1997). *Dissociation in Children and Adolescents: A Developmental Perspective*, New York, Guilford.

Hans Selye Also Discussed the Concept of Positive (vs. Negative) Stress

Selye, H. (1974). *Stress Without Distress*, Philadelphia, Lippincott.

George Chrousos and Colleagues Built upon and Expanded Selye’s Insights

George Chrousos and his colleagues continued to use the idea of the stress system as a framework for thinking about stress-related disorders into the present.

Chrousos, G. P. & Gold, P. W. (1992). ‘The Concepts of Stress and Stress System Disorders. Overview of Physical and Behavioral Homeostasis’. *JAMA*, 267, 1244–1252.

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Chapter 2. Going to See the Paediatrician

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Therapies Using Sound for the Treatment of Tinnitus

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Neuroscience References Showing That Activation of Brain Stress Systems Maintains Tinnitus

- Chen, Y. C., Xia, W., Chen, H., Feng, Y., Xu, J. J., Gu, J. P., Salvi, R. & Yin, X. (2017). ‘Tinnitus Distress Is Linked to Enhanced Resting-State Functional Connectivity from the Limbic System to the Auditory Cortex’. *Human Brain Mapping*, 38, 2384–2397.
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Chapter 3. The Family Assessment Interview: The Narrative, Formulation, and Discussion of Treatment Options

References Pertaining to the Safe Base

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- Simons, D. G., Travell, J. & Simons, L. S. (1999). *Myofascial Pain and Dysfunction: The Trigger Point Manual*, Baltimore, MD, Williams & Wilkins.

Chapter 4. The Stress-System Model for Functional Somatic Symptoms

Sigmund Freud and the Hypothesis of Child Sexual Trauma as the Origin of Functional Somatic Symptoms

This belief likely dates back to Freud's early observations of childhood sexual trauma as the origin of functional somatic symptoms in his patients (Freud 1962 [1896]). Later, Freud came to favour, in lieu of sexual trauma, the role of sexual fantasy or unconscious fears and wishes, and coined the term *conversion* to describe the process by which unacceptable mental contents (usually unconscious sexual conflicts) were transformed into somatic symptoms (Freud 1953 [1905]). Nonetheless, the idea that sexual abuse was potentially important in the aetiology of functional somatic symptoms continued to linger.

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Recent Studies Showing an Association Between Sexual Abuse and Lifetime Prevalence of Functional Somatic Symptoms or Syndromes

Many recent studies confirm that children who have been sexually abused have a higher lifetime prevalence of somatic symptoms or syndromes (Springer et al. 2007; Paras et al. 2009; Irish et al. 2010; Bonvanie et al. 2015).

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Association Between Exposure to War and Functional Somatic Symptoms

An increasing number of studies confirm that individuals exposed to war, war-related crimes, or other significant trauma have a higher prevalence of functional somatic symptoms (Yaari et al. 1999; Stermer et al. 1991; Joffe et al. 2003; Ablin et al. 2010).

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Adverse Childhood Experience (ACE) Studies

Similar findings to those of the original ACE study (of adults) run by Vincent Felitti and colleagues (1998) have been reported in studies with children (Flaherty et al. 2009; Kerker et al. 2015; Boullier and Blair 2018). Jack Shonkoff, paediatrician and director of the Center on the Developing Child at Harvard University, has noted that more than 50 reports from the ACE Study over the past 20 years have confirmed the association between ACEs and subsequent health problems, as first reported by Felitti (Shonkoff, 2016).

Boullier, M. & Blair, M. (2018). 'Adverse Childhood Experiences'.

Paediatrics and Child Health, 28, 132–137.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Koss, M. P. & Marks, J. S. (1998). 'Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults. The Adverse Childhood Experiences (ACE) Study'. *American Journal of Preventive Medicine*, 14, 245–258.

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Kerker, B. D., Zhang, J., Nadeem, E., Stein, R. E., Hurlburt, M. S., Heneghan, A., Landsverk, J. & McCue Horwitz, S. (2015). 'Adverse Childhood Experiences and Mental Health, Chronic Medical Conditions, and Development in Young Children. *Academic Pediatrics*, 15, 510–517.

Association Between Adverse Childhood Experiences (ACEs) and Functional Somatic Symptoms

The association between ACEs and functional somatic symptoms is reported in studies of functional neurological disorder (FND), irritable bowel syndrome, irritable bladder, fibromyalgia and widespread pain, and functional somatic symptoms in general.

For FND, see Bowman & Markland (1999), Kozłowska and colleagues (2011), Steffen and colleagues (2015), Steffen-Klatt and colleagues (2019), Kletenik and colleagues (2019), and Diez and colleagues (2020); for irritable bowel syndrome, see Bradford and colleagues (2012), Knight and colleagues (2015), and Park and colleagues (2016); for irritable bladder see Jundt and colleagues (2007); for fibromyalgia and widespread pain, see McInnes and colleagues (2019), Coppens and colleagues (2017), Nicol and colleagues (2016), and Yavne and colleagues (2018); for chronic fatigue syndrome, see Heim and colleagues (2006); and for functional somatic syndromes in general, see Rask and colleagues (2013) and Fischer and colleagues (2014).

Bowman, E. S. & Markand, O. N. (1999). ‘The Contribution of Life

Events to Pseudoseizure Occurrence in Adults’. *Bulletin of the Menninger Clinic*, 63, 70–88.

Bradford, K., Shih, W., Videlock, E. J., Presson, A. P., Naliboff, B. D., Mayer, E. A. & Chang, L. (2012). ‘Association Between Early Adverse Life Events and Irritable Bowel Syndrome’. *Clinical Gastroenterology and Hepatology*, 10, 385–90 e1–e3.

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Studies About Attachment Figures as Effective or Ineffective Psychobiological Regulators

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Association Between Attachment and Functional Somatic Symptoms

In a large study of 1327 Danish children – the Copenhagen Child Cohort 2000 – researchers found that problems with feeding, sleep, and tactile reactivity (marking a stress system that was dysregulated), as well as maternal psychiatric illness during the child's first year of life (marking a compromised attachment figure who was less able to help the child regulate), were associated with functional somatic symptoms in childhood (Rask et al., 2013). In a study of 292 Canadian children – the Maternal Adversity, Vulnerability and Neurodevelopment (MAVAN) study – deficits in maternal sensitivity at 18 months of age (which are associated with at-risk attachment strategies) were related to the presence of functional somatic symptoms by age 5 and in adulthood (Mauder et al., 2017).

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References to Studies from the First Author's PhD Research Program

For a lay summary of the research program, see Kozłowska (2016), and for a short neuroscience summary, see Kozłowska (2017).

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Kozłowska, K. (2017). 'A Stress-System Model for Functional Neurological Symptoms'. *Journal of the Neurological Sciences*, 383, 151–152.

Studies About Attachment in Children with FND and Children with Pain

Kozłowska, K., Scher, S. & Williams, L. M. (2011). 'Patterns of Emotional-Cognitive Functioning in Pediatric Conversion Patients: Implications for the Conceptualization of Conversion Disorders'. *Psychosomatic Medicine*, 73, 775–788.

Ratnamohan, L. & Kozłowska, K. (2017). 'When Things Get Complicated: At-Risk Attachment in Children and Adolescents with Chronic Pain'. *Clinical Child Psychology and Psychiatry*, 22, 588–602.

Studies About the Autonomic System in Children with FND, Mixed Functional Symptoms, and Pain

Chudleigh, C., Savage, B., Cruz, C., Lim, M., McClure, G., Palmer, D. M., Spooner, C. J. & Kozłowska, K. (2019). 'Use of Respiratory Rates and Heart Rate Variability in the Assessment and Treatment of Children

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- McInnis, P. M., Braund, T. A., Chua, Z. K. & Kozłowska, K. (2020). 'Stress-System Activation in Children with Chronic Pain: A Focus for Clinical Intervention'. *Clinical Child Psychology and Psychiatry*, 25, 78–97.

Studies Indicating Activation of the Motor System

- Reaction times to emotion faces are a proxy measure for motor readiness. Kozłowska and colleagues (2013) found that in children with FND, the reaction times were faster for all emotion faces. In that study, the raw scores for the reaction times can be found in Table 2 (p. 276). For a visual representation of these data and t-test results, see Kozłowska (2016).
- Kozłowska, K., Brown, K. J., Palmer, D. M. & Williams, L. M. (2013). 'Specific Biases for Identifying Facial Expression of Emotion in Children and Adolescents with Conversion Disorders'. *Psychosomatic Medicine*, 75, 272–280.
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Studies Suggesting a Shift Toward Low-Grade Inflammation

Kozłowska, K., Chung, J., Cruickshank, B., McLean, L., Scher, S., Dale, R. C., Mohammad, S. S., Singh-Grewal, D., Prabhuswamy, M. Y. & Patrick, E. (2018). ‘Blood CRP Levels Are Elevated in Children and Adolescents with Functional Neurological Symptom Disorder’. *European Child & Adolescent Psychiatry*, 28, 491–504.

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Studies where pain was the primary presenting problem

McInnis, P. M., Braund, T. A., Chua, Z. K. & Kozłowska, K. (2019). ‘Stress-System Activation in Children with Chronic Pain: A Focus for Clinical Intervention’. *Clinical Child Psychology and Psychiatry*, 25, 78–97.

Ratnamohan, L. & Kozłowska, K. (2017). ‘When Things Get Complicated: At-Risk Attachment in Children and Adolescents with Chronic Pain’. *Clinical Child Psychology and Psychiatry*, 22, 588–602.

Studies Documenting the Percentage of Comorbid Pain Alongside Other Functional Neurological Symptoms

Kozłowska, K., Griffiths, K. R., Foster, S. L., Linton, J., Williams, L. M. & Korgaonkar, M. S. (2017). ‘Grey Matter Abnormalities in Children and Adolescents with Functional Neurological Symptom Disorder’. *NeuroImage. Clinical*, 15, 306–314.

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Implications for the Conceptualization of Conversion Disorders'. *Psychosomatic Medicine*, 73, 775–88.

Studies Documenting the Percentage of Comorbid Fatigue Alongside Other Functional Neurological Symptoms or Chronic/Complex Pain

Kozłowska, K., Griffiths, K. R., Foster, S. L., Linton, J., Williams, L. M. & Korgaonkar, M. S. (2017). 'Grey Matter Abnormalities in Children and Adolescents with Functional Neurological Symptom Disorder'. *NeuroImage. Clinical*, 15, 306–314.

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Chapter 10. The Role of the Gut in the Neurobiology of Functional Somatic Symptoms

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Chapter 13. Principles of Assessment and Treatment

Terms Used in the Literature to Describe the Systems Approach to Working with Children with Functional Somatic Symptoms and Their Families

The biopsychosocial approach

Sara Williams and Nicole Zahka (2017) provide a nice handout for documenting biopsychosocial factors pertaining to the child's presentation (Appendix, Handout 5, p. 225).

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Lask, B. & Fosson, A. (1989). *Childhood Illness: The Psychosomatic Approach: Children Talking with Their Bodies*, Chichester, Sussex, Wiley.

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Multimodal rehabilitation

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Family behavioural programs

Garralda, M. E. (2010). ‘Unexplained Physical Complaints’. *Child and Adolescent Psychiatric Clinics of North America*, 19, 199–209, vii.

System-level interventions

Guite, J. W., Logan, D. E., Ely, E. A. & Weisman, S. J. (2012). ‘The Ripple Effect: Systems-Level Interventions to Ameliorate Pediatric Pain’. *Pain Management*, 2, 593–601.

Intensive interdisciplinary treatment

Hechler, T., Kanstrup, M., Holley, A. L., Simons, L. E., Wicksell, R., Hirschfeld, G. & Zernikow, B. (2015). ‘Systematic Review on Intensive Interdisciplinary Pain Treatment of Children with Chronic Pain’. *Pediatrics*, 136, 115–127.

The big picture approach or . . . The bigger picture approach

Forum for Youth Investment. (2020). *A Big Picture Approach*.
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Cases Published in the Literature That Apply Interventions on Multiple System Levels and That Use the Stress-System Formulation to Guide Treatment

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Chapter 14. Treatment Interventions I: Working with the Body

Additional References by Jon Kabat-Zinn or Pertaining to Outcomes for the Mindfulness-Based Stress Reduction (MBSR) Program

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References Pertaining to Meditations with Movement

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Other Group Activities Involving Synchronized Movement That Creates Pleasurable Body Sensations, Connection with Others, and Behavioural Synchrony, and That Increases Pain Thresholds

- Fancourt, D., Perkins, R., Ascenso, S., Carvalho, L. A., Steptoe, A. & Williamon, A. (2016). 'Effects of Group Drumming Interventions on Anxiety, Depression, Social Resilience and Inflammatory Immune Response Among Mental Health Service Users'. *PLoS One*, 11, e0151136.
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Resources for Achieving Diaphragmatic Breathing

- James, A. (2015). *10 Breathing Practices for Kids*.
<https://kiddingaroundyoga.com/blog/kids-breathing-pranayam-teach/>
- JD McCarty Center (2011). *Using Visual Supports in Yoga Groups for Kids & Teens – Being Inclusive of Learning Styles*.
<https://omazingkidsllc.com/2011/10/11/using-visual-supports-in-yoga-groups-for-kids-teens-being-inclusive-of-learning-styles/>
- Little Twisters Yoga. *Little Twisters Yoga and Emotional Wellness*.
<https://littletwistersyoga.com/>
- Paccione, C. E. & Jacobsen, H. B. (2019). 'Motivational Non-directive Resonance Breathing as a Treatment for Chronic Widespread Pain'. *Frontiers in Psychology*, 10, 1207.
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Bee Breathing/Bumble Bee Breathing

- James, A. (2015). *10 Breathing Practices for Kids*.
<https://kiddingaroundyoga.com/blog/kids-breathing-pranayam-teach/>

Concrete Physical Exercises Using Large Muscle Groups for Providing Containment

Selvam, R. & Parker, L. A. *Restoration of Body Resources Lost in Trauma (Based on the Biodynamic Somatic Developmental Psychology Model)*
<https://files.constantcontact.com/e781880d201/6f85b136-cd4a-4c0e-81d3-c79d30e6e021.pdf>

Resources for Progressive Muscle Relaxation

For a progressive muscle relaxation script, see
<https://www.baylor.edu/content/services/document.php/183466.pdf>.

Resources for Bottom-Up Mindfulness Practice Resources

For resources, see Cyruha: Make Meditation Yours. *Meditation Exercises*.
<https://www.cyruba.org/meditation-exercises/>

Research About the Mechanisms That Underpin the Health Benefits of Voluntary Regular Exercise

- Greenwood, B. N. (2019). ‘The Role of Dopamine in Overcoming Aversion with Exercise’. *Brain Research*, 1713, 102–108.
- Mailing, L. J., Allen, J. M., Buford, T. W., Fields, C. J. & Woods, J. A. (2019). ‘Exercise and the Gut Microbiome: A Review of the Evidence, Potential Mechanisms, and Implications for Human Health’. *Exercise and Sport Sciences Reviews*, 47, 75–85.
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For literature pertaining to the positive health benefits of physical activities that involve synchronous behaviour and that are done with other people, see above section ‘Other group activities involving synchronized movement that creates pleasurable body sensations, connection with others, and behavioural synchrony, and that increases pain thresholds’.

Eye Movement Desensitization and Reprocessing (EMDR)

- Pagani, M., Di Lorenzo, G., Monaco, L., Daverio, A., Giannoudas, I., La Porta, P., Verardo, A. R., Niolu, C., Fernandez, I. & Siracusano, A. (2015). ‘Neurobiological Response to EMDR Therapy in Clients with Different Psychological Traumas’. *Frontiers in Psychology*, 6, 1614.
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- Wilson, G., Farrell, D., Barron, I., Hutchins, J., Whybrow, D. & Kiernan, M. D. (2018). ‘The Use of Eye-Movement Desensitization Reprocessing (EMDR) Therapy in Treating Post-traumatic Stress Disorder – a Systematic Narrative Review’. *Frontiers in Psychology*, 9, 923.

The Flash Technique

- Manfield, P., Lovett, J., Engel, L. & Manfield, D. (2017). ‘Use of the Flash Technique in EMDR Therapy: Four Case Examples’. *Journal of EMDR Practice & Research*, 11, 195–205.

References Pertaining to Somatic Experiencing

- Andersen, T. E., Yael Lahava, Y., Ellegaard, H. & Mannichec, C. (2017). 'A Randomized Controlled Trial of Brief Somatic Experiencing for Chronic Low Back Pain and Comorbid Post-traumatic Stress Disorder Symptoms'. *European Journal of Psychotraumatology*, 8, 1331108.
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Other Trauma-Processing Interventions

Radical exposure tapping

- Church, D., Hawk, C., Brooks, A. J., Toukolehto, O., Wren, M., Dinter, I. & Stein, P. (2013). 'Psychological Trauma Symptom Improvement in Veterans Using Emotional Freedom Techniques: A Randomized Controlled Trial'. *Journal of Nervous and Mental Disease*, 201, 153–160.
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The progressive counting technique

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References Pertaining to Neuromodulation

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- Leonard, G., Lapierre, Y., Chen, J. K., Wardini, R., Crane, J. & Pfito, A. (2017). ‘Noninvasive Tongue Stimulation Combined with Intensive Cognitive and Physical Rehabilitation Induces Neuroplastic Changes in Patients with Multiple Sclerosis: A Multimodal Neuroimaging Study’. *Multiple Sclerosis Journal – Experimental, Translational and Clinical*, 3, 2055217317690561.
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Chapter 15. Treatment Interventions II: Working with the Mind

For a discussion (and references) to the three different waves of cognitive-behavioural therapy, see Online Supplement 15.1

Additional Resources for Visualization Scripts and Mindfulness Exercises

For a visualization script using imagery of protective light, see the following:

Inner Health Studio (2018). *Protective Light Visualization Relaxation Script*.
<https://www.innerhealthstudio.com/protective-light.html>

For additional exercises, see the following:

Prevent (2017). Cure Your Headache with This 1-Minute Meditation.
<https://www.prevention.com/health/a20499696/cure-your-headache-with-this-1-minute-meditation>

Budilovsky, J. & Adamson, E. (2003). *The Complete Idiot's Guide to Meditation*, New York, Penguin [in particular, 'For Chronic Pain, Especially Back Pain', p. 317].

A wealth of mindfulness exercises are now available on the internet. For example, search for 'Leaves on a Stream' mindfulness exercises, or see 'Thought Clouds' on the Stanford Medicine website, <https://mindful.stanford.edu/2015/06/thought-clouds/>.

References Pertaining to Hypnosis with Children

The following references were cited in the commentary by the third author (HH) in Khachane and colleagues (2019), ‘Twisted in Pain: The Multidisciplinary Treatment Approach to Functional Dystonia’, *Harvard Review of Psychiatry*, 27, 359–381.

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