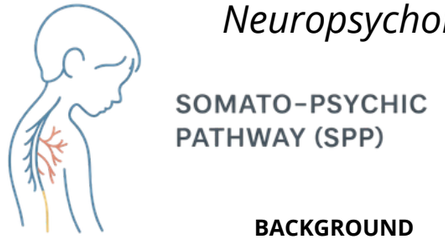
Somatic and Autonomic Dysregulation as Pathophysiological Constraints on Higher Brain Function



Neuropsychological Outcomes After Manual Therapy for Axial Dysfunction with Secondary Autonomic Dysregulation: Results from 135 Children in Two Cohorts Aged 2–6 and 6–12 Years

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BACKGROUND

Higher cognitive, emotional, and behavioral functions develop within continuously interacting somatic and autonomic regulatory systems. Developmental neuroscience increasingly suggests that autonomic balance, sleep regulation, sensorimotor organization, and bodily state regulation substantially influence attention, emotional control, adaptive functioning, and higher brain function.

The Somato-Psychic Pathway (SPP) is proposed as an integrative developmental framework describing how persistent somatic dysfunction and associated autonomic dysregulation may constrain neuropsychological functioning in at least a subset of pediatric patients.

Within this framework, cognitive, emotional, and behavioral symptoms are interpreted not exclusively as primary cortical dysfunction, but potentially also as manifestations of state-dependent regulatory limitations arising from chronic somatic-autonomic dysregulation.

OBJECTIVE

To explore whether persistent somatic dysfunction and associated autonomic dysregulation may represent clinically relevant constraints on higher neuropsychological functioning in children presenting with cognitive, emotional, and behavioral difficulties.

METHODS

Retrospective observational cohort of 135 children aged 2–12 years evaluated in a neurodevelopmental outpatient clinic for attentional, emotional, behavioral, sleep-related, and developmental difficulties.

Children underwent individualized, somatically oriented interventions targeting axial dysfunction and associated autonomic dysregulation as part of routine clinical care.

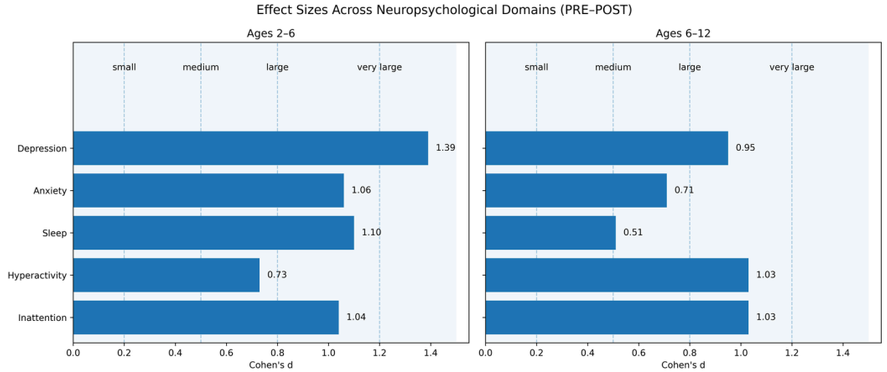
MEASURES

- ADHD Rating Scale-IV; SNAP-IV; Revised Child Anxiety and Depression Scale (RCADS); Children's Sleep Habits Questionnaire (CSHQ)
- Pre–and post-clinical changes were analyzed using paired statistical tests and standardized effect size estimates *(Cohen's d).*

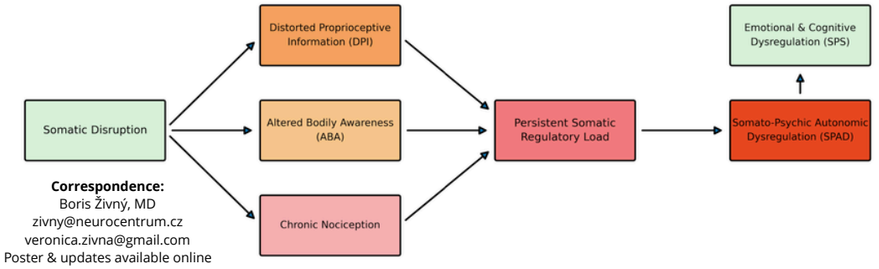
RESULTS

Significant post-treatment improvements were observed across all measured domains, including sleep, attention, emotional regulation, anxiety, mood, and behavioral functioning ($p < 0.05$; most $p < 0.001$).

Observed effect sizes ranged from medium to large (Cohen's d = 0.4–1.4), indicating clinically meaningful functional changes across both age cohorts. No adverse effects were reported.



Somato-Psychic Pathway (SPP): Conceptual Framework



CONCLUSION

Findings support the possibility that persistent somatic dysfunction and associated autonomic dysregulation may function as clinically relevant constraints on higher neuropsychological functioning in at least a subset of pediatric patients. Within this framework, cognitive, emotional, and behavioral symptoms may partly reflect state-dependent regulatory limitations rather than exclusively primary cortical dysfunction. Prospective controlled studies incorporating objective autonomic measures and longitudinal developmental follow-up are needed.

CLINICAL RELEVANCE

These findings suggest that bottom-up influences arising from somatic and autonomic regulatory systems may contribute to neuropsychological symptoms and functioning and should be considered in developmental neuropsychological evaluation and interpretation.

The proposed framework highlights the potential importance of autonomic regulation, bodily state organization, and developmental regulatory capacity in shaping children's attentional, emotional, and adaptive functioning.

NEUROPSYCHOLOGICAL IMPLICATIONS

- Neuropsychological functioning may be more state-dependent than commonly assumed
- Somatic and autonomic regulatory factors may influence attention, emotional regulation, and adaptive functioning
- Developmental assessment may benefit from the inclusion of autonomic and regulatory variables
- Transdiagnostic symptom presentations may partly reflect upstream regulatory constraints
- Interdisciplinary developmental models may improve neuropsychological interpretation and treatment planning

LIMITATIONS

Limitations include the retrospective observational design, the absence of a control group, reliance on parent-reported outcomes, and the lack of objective autonomic markers. These factors limit causal interpretation, highlighting the need for prospective controlled studies with objective measures.

Živný, B. (2026). Somato-Psychic Pathway: A Universal Developmental Trajectory Linking Somatic Structural–Functional Integrity, Autonomic Regulation, and the Emergence of Mind. *Frontiers in Integrative Neuroscience, 20*, 1771123. https://doi.org/10.3389/fnint.2026.1771123

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