

Are Personalized Neuro-Plasticity-Oriented Interventions available for Neurodevelopmental and Psychiatric Disorders?

While neuroplasticity-based treatments exist, fully personalized interventions for neurodevelopmental and psychiatric disorders are still emerging and not yet routine.

Are personalized neuroplasticity-oriented interventions currently available for neurodevelopmental and psychiatric disorders?

N = 5

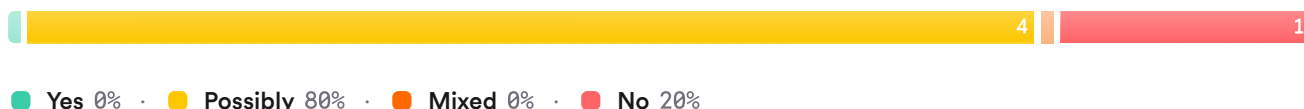


FIGURE 1 Overall consensus on availability of personalized plasticity care

Neuroplasticity—how the brain changes with experience—is a major target for new treatments in conditions like autism, schizophrenia, ADHD, and depression. Current research shows many ways to enhance plasticity, but precision, individually tailored use is only partly realized so far.

Types of Neuroplasticity-Oriented Interventions

- **Cognitive and digital training:** Computerized cognitive remediation in schizophrenia improves executive function and increases hippocampal volume; VR-based training in autism improves attention and planning, showing circuit-level plastic change (Kesidou et al., 2025; Choi et al., 2025; Lee et al., 2025).
- **Neuromodulation and brain stimulation:** Non-invasive brain stimulation (e.g., TMS) and electroconvulsive therapy can enhance plasticity and reduce depressive symptoms, especially when paired with psychotherapy or cognitive training (Kesidou et al., 2025; Wang et al., 2023; Cramer et al., 2011).
- **Pharmacological enhancers:** Ketamine, D-cycloserine, other glutamatergic agents, SSRIs, psychedelics, and compounds like sulforaphane are discussed as plasticity-enhancing tools (Branchi, 2025; Mascaro et al., 2026; Wang et al., 2023; O'Donnell et al., 2026).
- **VR/BCI technologies:** VR and brain-computer interface combinations can be tailored to stimulate specific brain regions and adapt in real time, with promising rehabilitation and anxiety applications (Kesidou et al., 2025; Loth et al., 2016; Drigas & Sideraki, 2024).
- **Lifestyle and behavioral approaches:** Exercise, environmental enrichment, and structured behavioral therapies are robust drivers of plasticity across ages (Mascaro et al., 2026; Wang et al., 2023; Cramer et al., 2011).

Examples of Disorder Areas and Approaches

Disorder area	Plasticity-focused approaches in use or testing	Citations
Autism / DDs	Digital cognitive/VR training; stratification by biology proposed	(Kesidou et al., 2025; Choi et al., 2025; Gabis et al., 2021; Perez-Cano et al., 2023; Lee et al., 2025; Starčević & Kostic, 2026; Uljarević et al., 2025)

Disorder area	Plasticity-focused approaches in use or testing	Citations
Schizophrenia	Cognitive remediation; neuromodulation; plasticity biomarkers	(Kesidou et al., 2025; Choi et al., 2025; Chen & Geschwind, 2022; Cramer et al., 2011)
Depression	Ketamine, ECT, TMS combined with CBT/behavioral work	(Branchi, 2025; Wang et al., 2023; O'Donnell et al., 2026; Cramer et al., 2011)
Pediatric disorders	Medication + behavioral therapies with observed brain changes	(Lee et al., 2025; Starčević & Kostic, 2026; Cramer et al., 2011)

FIGURE 2 Examples of plasticity-based approaches by disorder

Personalization and Precision Status

- **Conceptual frameworks:** Precision psychiatry proposes measuring individual “plasticity levels” (e.g., symptom network connectivity) to stratify patients and select treatments (Branchi, 2025; Herzberg et al., 2024; O'Donnell et al., 2026).
- **Biomarker-guided stratification:** For autism and other neurodevelopmental disorders, biologically anchored subtypes and omics-based profiles are being developed to match interventions to mechanisms and sensitive developmental windows (Choi et al., 2025; Merzenich et al., 2014; Wilkinson et al., 2019; Gabis et al., 2021; Chen & Geschwind, 2022; Perez-Cano et al., 2023; Starčević & Kostic, 2026).
- **Adaptive, tech-enabled personalization:** Personalized VR and BCI experiences adjusted with real-time brain signals are described as promising but still largely research-stage (Loth et al., 2016; Lee et al., 2025; Drigas & Sideraki, 2024).

Challenges and Future Directions

- Need for **validated biomarkers of plasticity** to time and tailor interventions (Kesidou et al., 2025; Mascaro et al., 2026; Gazerani, 2025; Herzberg et al., 2024; Cramer et al., 2011).
- Most evidence comes from **small or early-phase studies**; large randomized trials and fully “crossed” designs to prove synergy and personalization are rare (Kesidou et al., 2025; Wang et al., 2023; Gazerani, 2025; Cramer et al., 2011).
- Integration of genetics, multi-omics, imaging, and real-time data for true precision care is in its **early stages**, not standard clinical practice (Tanaka, 2025; Merzenich et al., 2014; Wilkinson et al., 2019; Gazerani, 2025; Chen & Geschwind, 2022; Perez-Cano et al., 2023).

Conclusion

Neuroplasticity-oriented treatments (cognitive training, neuromodulation, certain medications, VR/BCI, exercise, psychotherapy) are already used for several neurodevelopmental and psychiatric disorders. However, making these truly **personalized**—selected and timed based on each person’s biology, plasticity level, and context—is mostly a developing research direction rather than a routine clinical reality today.

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