Enhancing Mental Health using Virtual Reality

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Public health experts have recently raised the alarm about a "mental health crisis" among young people that has steadily worsened over the past decade. Unfortunately, mental health care systems have been unable to meet this growing demand. Early detection and prevention strategies, which have been highly successful in other fields of medicine, have not been systematically adopted to reduce rates of psychiatric disorders. We propose an approach focusing on the less severe and less differentiated earlier stages of psychopathology than current mental health programs have to date, which may be more cost-effective and beneficial.

The MGH Resilience and Prevention Program aims to develop, test, and implement transdiagnostic (i.e., focused on multiple conditions) prevention strategies in psychiatry using cognitive neuroscience and evidence-based behavioral approaches. We developed an immersive, multi-user virtual reality (VR) application to deliver a previously validated behavioral intervention called Resilience Training (RT; Burke et al., 2020; DeTore, Luther et al., 2022; DeTore et al., 2024; Holt et al., under review). VR-RT comprises six one-hour sessions which include up to 10 participants and two trained co-leaders. The sessions teach evidence-based skills, such as mindfulness, self-compassion, and mentalization, that have been shown to improve emotional and social functioning. The manualized sessions include didactic portions, experiential exercises, group discussions, and assignment and review of home practice. The attention-capturing features of VR enhance engagement and learning, and the simulated experience of being physically near others ("social presence") heightens the impact of the sessions. A key advantage of this platform is its accessibility and anonymity, as users participate as avatars from any location.

In a pilot study of this application with 33 young adults, 90.3% rated the application as beneficial and useful. Following completion of the program, participants' comfort with others and social perception significantly improved. In a second study conducted in 26 adults with mild, subclinical symptoms of depression, we found that a measure of resilience and self-efficacy significantly improved and symptoms of depression and anxiety significantly decreased following the 6-week program. Taken together, our findings thus far suggest that VR-adapted RT represents a feasible, scalable approach for improving emotional resilience in at-risk young people.
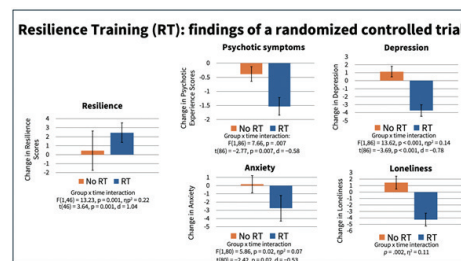

Figure 1: In a randomized waitlist-controlled trial of Resilience Training (RT), RT led to significant increases in a measure of cognitions and traits linked to emotional resilience (p < 0.001) as well as several resilience-associated capacities such as mindfulness (p = 0.006) and self-compassion (p= 0.006). RT also led to decreases in transdiagnostic symptoms of psychopathology (subclinical psychosis, depression, anxiety) as well as loneliness, compared to the waitlist control group (all p < 0.02). See DeTore, Luther et al., Psychological Medicine 2022.
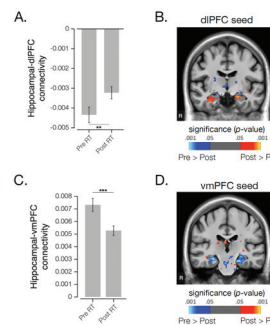

Figure 2: Functional magnetic resonance imaging (fMRI) evidence that RT influences the function of brain circuits involved in emotion regulation. The functional connectivity strength of the hippocampal-dorsolateral prefrontal cortex (dlPFC) pathway was significantly greater (A) while that of the hippocampal-ventromedial prefrontal cortex (vmPFC) pathway was significantly lower (C) following RT (n=41). B, D: representative coronal views of results of a voxel-wise paired t-test comparing pre-RT vs. post-RT connectivity of the two cortical seeds. ** p < .01; *** p < .001.

Figure 3: Three participants (as their avatars) in one of the virtual environments of VR-RT. Each participant uses an Oculus VR headset to participate.