

Depression among children and adolescents is one of the most pressing challenges in contemporary psychiatry and public health. It is estimated that nearly 5% of the global population experiences a depressive episode annually, with an increasing number of cases occurring in young individuals. For some patients, the first symptoms of depression emerge in childhood, with a sharp rise in incidence during adolescence. Despite growing societal awareness, access to effective, modern, and engaging therapeutic interventions remains insufficient. Although psychotherapy and pharmacotherapy constitute the standard treatment approaches, approximately one-third of young patients do not achieve full remission of symptoms. Consequently, there is a growing need to develop innovative strategies to support the treatment of depression and enhance therapeutic outcomes and quality of life for this population. While the use of virtual reality (VR) in psychotherapy is gaining increasing attention, studies exploring its application in treating depression among children and adolescents are limited. Existing research has primarily focused on adults, older adults, or individuals with anxiety disorders, leaving a significant gap regarding the efficacy of immersive VR environments for adolescents diagnosed with depression. This project seeks to address this gap by integrating modern technology with a psychophysiological approach.

The objective of the proposed study is to evaluate the effectiveness of a relaxation and breathing program in reducing depressive symptoms and improving respiratory function and physiological responses. The study aims to answer the following research questions:

1. Does immersive VR therapy reduce depressive symptoms in adolescents?
2. Does VR-based intervention influence heart rate variability (HRV)?
3. Does VR therapy improve participants' respiratory function?
4. Is immersive VR therapy well tolerated by young patients in terms of cybersickness symptoms?
5. Do intervention effects differ between the experimental and control groups?

This research topic is justified by both its scientific relevance and practical potential. To date, no studies in Poland have examined the use of immersive VR-based breathing and relaxation therapy in adolescents with depression. Given the increasing burden on mental health services for children and adolescents, this method could represent a scalable and modern therapeutic tool. The project is characterized by a high degree of innovation, interdisciplinary design, and potential impact on future clinical practice. It may contribute to the development of personalized psychological support strategies, especially for patients who find it difficult to engage in traditional therapy formats. The findings could inform the design of novel, more acceptable models of psychological intervention.

The project involves a randomized controlled trial with 50 participants aged 12–18 years, all diagnosed with clinical depression and recruited from the specialist therapeutic center Soteria Anemja in Opole. Participants will be randomly assigned to either the experimental group (immersive VR therapy using TierOne GO goggles and the “box breathing” technique) or the control group (audio-guided relaxation without VR). Both groups will participate in six 20-minute sessions over a two-week period. Outcome measures will be assessed at three time points (pre-intervention, post-intervention, and 2-week follow-up), including depressive symptoms, perceived stress, respiratory function, and heart rate variability. In the VR group, symptoms of simulator sickness will also be monitored using the Virtual Reality Sickness Questionnaire (VRSQ).

**Heart Rate Variability (HRV) Assessment.** To analyze psychophysiological markers of relaxation, the Polar H10 device with a dedicated analytical application will be used. The following HRV parameters will be examined: RMSSD, SDNN, HF, LF, and the LF/HF ratio.

**Respiratory Function Assessment.** Respiratory function will be measured using the K5 diagnostic and training respiratory trainer. This device records key parameters such as tidal volume (TV), airflow rate (Flow), and the 5 Index respiratory strength indicator.

**Depressive Symptom Severity Assessment.** The severity of depressive symptoms will be evaluated using the Beck Youth Inventory – Depression Scale (BYI-II).

**Perceived Stress Assessment.** The Perceived Stress Scale (PSS-10) will be used to assess subjective levels of stress.

**Cybersickness Symptom Assessment.** Potential adverse effects related to VR usage will be identified using the standardized Virtual Reality Sickness Questionnaire (VRSQ).

**VR Therapy.** The immersive breathing and relaxation therapy will be conducted using the TierOne GO system. The intervention will involve a therapeutic VR film titled “State of Balance”, combined with guided breathing exercises using the 4-4-4-4 technique. Sessions will be conducted in a seated position using portable VR goggles and in-ear headphones, in an environment designed to minimize external stimuli.

Expected outcomes include a significant reduction in depressive symptoms, improvement in HRV and respiratory parameters, and high acceptance and tolerance of the therapy among adolescents. The results may have implications not only for clinical practice but also for the design of modern therapeutic programs utilizing immersive technologies.