

Investigators highlight potential of exercise in addressing substance abuse in teens

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Exercise has numerous, well-documented health benefits. Could it also play a role in preventing and reducing substance misuse and abuse in adolescents? This is the intriguing question that a team of investigators from Case Western Reserve University School of Medicine and Cleveland Clinic seeks to answer.

In a review article recently published in *Birth Defects Research*, the trio of researchers supplies a rationale for the use of [exercise](#), particularly assisted exercise, in the prevention and adjunctive treatment of substance-use disorders - including alcohol, marijuana, cocaine, opioids, and heroin. (Adjunctive treatments supplement the primary treatment when tackling a disease, while examples of assisted exercise include the pedaling of a fellow cyclist on a tandem bicycle and a specially designed indoor cycle which provides mechanical assistance to pedal faster.)

"Although use-rates for most [substances](#) have remained relatively stable, the frequency of marijuana use and the perception that regular marijuana use is not harmful has increased in adolescents," said the piece's lead author, Nora L. Nock, PhD, associate professor of population and quantitative health sciences at Case Western Reserve University's School of Medicine. "In addition, nonmedical use of opioids has increased in teens, particularly in the South, Midwest, and rural low-income communities."

A chief reason for teen substance use is that risk-taking behaviors accelerate during these years, with a goal and subsequent feeling of

reward. Underdeveloped connections, or an "imbalance," between cognitive and emotional decision-making mechanisms in the brain are present in all adolescents as a natural process, resulting in impulsive or risky behaviors. "We think that substance use, which may cause adverse structural and functional brain changes, may exacerbate this imbalance, potentially leading to substance-use disorders as well as other behavioral problems," said Nock. "Exercise may help to reinforce these underdeveloped connections between reward and regulatory processes and offset reward-seeking from substance use in adolescents."

While encouraging exercise in all teens, Nock and co-authors, Sonia Minnes, PhD, associate professor of social work at the Jack, Joseph and Morton Mandel School of Applied Social Sciences at Case Western Reserve University and Jay L. Alberts, PhD, Edward F. and Barbara A. Bell Family Endowed Chair at Cleveland Clinic's Lerner Research Institute, and assistant professor of biomedical engineering at Cleveland Clinic Lerner College of Medicine, propose assisted exercise as a potentially superior solution for preventing or helping end substance misuse. They have previously shown that mechanical assistance in pedaling for patients with Parkinson's disease leads to cycling rates as much as 35 percent faster than unaided cycling, leading to increased activity in select cortical and sub-cortical regions of the brain.

"Our team has shown that assisted exercise can improve central motor control processing and other functioning in Parkinson's disease patients," said Alberts. "This new work shows forced exercise also may also provide particular benefits to substance use disorder patients, especially those with dopamine deficits - which can result from drug use, poor nutrition, stress, and lack of sleep, and result in depression, fatigue, apathy, and mood swings."

Drawing on this and other research, the authors hypothesize that assisted exercise may provide particular benefits to substance-use disorder

patients. "We believe," they write in the piece, that "exercise (and, potentially assisted exercise) should be included as an adjunctive component to existing substance use treatment programs and should be offered as a preventative measure to adolescents at high risk for substance abuse based on their family history, mental health, genetic and neurocognitive profiles and other risk factors."

Given the shortage of randomized trials in adolescents, additional studies are needed to determine which dose (frequency, intensity, duration, length), type (aerobic, resistance training) and format (assisted, standard) of exercise is most effective. More broadly, the authors write that "assisted exercise ... might be more beneficial than standard [exercise] for a variety of diseases and conditions, [such as] ... obesity and neurological diseases including Parkinson's."

Their next steps include formally testing, via a randomized trial, assisted cycling vs. standard cycling as an adjunctive treatment in substance-abuse disease.

More information: Nora L. Nock et al, Neurobiology of substance use in adolescents and potential therapeutic effects of exercise for prevention and treatment of substance use disorders, *Birth Defects Research* (2017). [DOI: 10.1002/bdr2.1182](https://doi.org/10.1002/bdr2.1182)

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